Series 1961, No. 26 Issued September 1965

SOIL SURVEY

Amador Area, California

UNITED STATES DEPARTMENT OF AGRICULTURE
Soil Conservation Service
in cooperation with
CALIFORNIA AGRICULTURAL EXPERIMENT STATION

HOW TO USE THE SOIL SURVEY REPORT

THIS SOIL SURVEY of the Amador Area, will serve several groups of readers. It will help farmers in planning the kind of management that will protect their soils and provide good yields; assist engineers in selecting sites for roads, buildings, ponds, and other structures; aid foresters in managing woodlands; and add to our knowledge of soil science.

Locating soils

Use the index to map sheets at the back of this report to locate areas on the large map. The index is a small map of the county numbered to show where each sheet of the large map is located. When the correct sheet of the large map has been found, it will be seen that boundaries of the soils are outlined, and that there is a symbol for each kind of soil on the map. Suppose, for example, an area located on the map has the symbol ApD. The legend for the detailed map shows that this symbol identifies Auburn silt loam, 0 to 31 percent slopes. This soil and all others mapped in the county are described in the section "Descriptions of the Soils."

Finding Information

This report contains sections that will interest different groups of readers, as well as some sections that may be of interest to all.

Farmers and those who work with farmers can learn about the soils in the section "Descriptions of the Soils" and then turn to the section "Use and Management of the Soils." In this way, they first identify the soils on their farm and then learn how these soils can be managed and what yields can be expected. The "Guide to Mapping Units, Capability Units, Pasture and Range Sites, and Woodland Suitability Groups" at the back of the report will simplify use of the map and report. This guide lists each soil and land type mapped in the county and the page where each is described. It also lists, for each soil and land type, the capability unit, the pasture and range site, the woodland suitability group, and the pages where each of these is described.

Foresters and others interested in woodlands can refer to the section "Woodland Uses of the Soils." In that section the soils in the county are grouped according to their suitability for trees, and factors affecting the management of woodland are explained.

Engineers will want to refer to the section "Engineering Interpretations." Tables in that section show characteristics of the soils that affect engineering.

Scientists and others who are interested will find information about how the soils were formed and how they were classified in the section "Formation, Morphology, and Classification of Soils."

Students, teachers, and other users will find information about soils and their management in various parts of the report, depending on their particular interest.

Newcomers in the Area will be especially interested in the section "General Soil Map," where broad patterns of soils are described. They may also be interested in the section "General Nature of the Area," which gives additional information about the county.

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Fieldwork for this survey was completed in 1961. Unless otherwise indicated, all statements in the report refer to conditions in the Area at that time. The soil survey of the Amador Area was made by the Soil Conservation Service and the California Agricultural Experiment Station and is part of the technical assistance furnished to the Amador County Soil Conservation District.

Cover picture: Vineyards on soils of the Ahwahnee and Sierra series in the Shenandoah Valley.

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SOIL SURVEY OF THE AMADOR AREA, CALIFORNIA

REPORT BY HAROLD R. SKETCHLEY, SOIL SCIENTIST, SOIL CONSERVATION SERVICE

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UNITED STATES DEPARTMENT OF AGRICULTURE AND THE CALIFORNIA AGRICULTURAL EXPERIMENT STATION

AMADOR AREA is east of the Great Valley of California (fig. 1). The Area comprises the western three-quarters of Amador County. Most of the privately owned land in the county is in the Amador Area; the rest of the county is in the Eldorado National Forest. The total extent of the Area is approximately 298,992 acres. The survey covers the Amador County Soil Conservation District and adjoining land up to the boundary of the Eldorado National Forest.

Amador County is one of the smaller mountain counties on the western slope of the Sierra Nevada Range in central California. It is narrow, long, and somewhat irregular in shape. To the west the county merges with the Great Valley of California, and to the east it extends to the crest of the Sierras. The south fork of the Cosumnes River forms the northern boundary of the county, and the Mokelumne River is the border on the south. The county is roughly 54 miles long. Its elevation ranges from 250 feet in the low foothills to more than 9,000 feet in mountainous peaks near the eastern boundary. About three-fourths of the county is mapped in the survey Area.

Figure 1.—Location of Amador Area in California.

In the 1840's gold was discovered in the county and in adjoining counties, and this led to exploration and development of the county. Today, the grassy lower foothills are used chiefly as range for beef cattle. At higher elevations are mainly forests of conifers and hardwoods. Ponderosa pine is the dominant species cut for lumber. A fairly large acreage is in brush, and about 2 percent of the soils in the survey Area are used for crops, mainly barley, oats, corn, milo, wheat, wine grapes, walnuts, prunes, and apples. Irrigation water is scarce, and most crops are grown without irrigation.

How Soils Are Mapped and Classified

Soil scientists made this survey to learn what kinds of soils are in the Amador Area, where they are located, and how they can be used.

They went into the Area knowing they likely would find many soils they had already seen, and perhaps some they had not. As they traveled over the Area, they observed steepness, length, and shape of slopes; size and speed of streams; kinds of native plants or crops; kinds of rock; and many facts about the soils. They dug many holes to expose soil profiles. A profile is the sequence of natural layers, or horizons, in a soil; it extends from the surface down into the parent material that has not been changed much by leaching or by roots of plants.

The soil scientists made comparisons among the profiles they studied, and they compared these profiles with those in counties nearby and in places more distant. They classified and named the soils according to nationwide, uniform procedures. To use this report efficiently, it is necessary to know the kinds of groupings most used in a local soil classification.

Soils that have profiles almost alike make up a soil series. Except for different texture in the surface layer, all the soils of one series have major horizons that are

similar in thickness, arrangement, and other important characteristics. Each soil series is named for a town or other geographic feature near the place where a soil of that series was first observed and mapped. Fiddletown and Mokelumne, for example, are the names of two soil series. All the soils in the United States having the same series name are essentially alike in those characteristics that go with their behavior in the natural, untouched landscape. Soils of one series can differ somewhat in texture of the surface soil and in slope, stoniness, or some other characteristic that affects use of the soils by man.

Many soil series contain soils that differ in texture of their surface layer. According to such differences in texture, separations called soil types are made. Within a series, all the soils having a surface layer of the same texture belong to one soil type. Honcut silt loam and Honcut very fine sandy loam are two soil types in the Honcut series. The difference in texture of their surface layers is apparent from their names.

Some soil types vary so much in slope, degree of erosion, number and size of stones, or some other feature affecting their use, that practical suggestions about their management could not be made if they were shown on the soil map as one unit. Such soil types are divided into phases. The name of a soil phase indicates a feature that affects management. For example, Ahwahnee loam, 3 to 9 percent slopes, is one of several phases of Ahwahnee loam, a soil type that ranges from nearly level to steep.

After a guide for classifying and naming the soils had been worked out, the soil scientists drew the boundaries of the individual soils on aerial photographs. These photographs show woodlands, buildings, field borders, trees, and other details that greatly help in drawing boundaries accurately. The soil map in the back of this report was prepared from the aerial photographs.

The areas shown on a soil map are called mapping units. On most maps detailed enough to be useful in planning management of farms and fields, a mapping unit is nearly equivalent to a soil type or a phase of a soil type. It is not exactly equivalent, because it is not practical to show on such a map all the small, scattered bits of soil of some other kind that have been seen within an area that is dominantly of a recognized soil type or soil phase.

In preparing some detailed maps, the soil scientists have a problem of delineating areas where different kinds of soils are so intricately mixed, and so small in size, that it is not practical to show them separately on the map. Therefore, they show this mixture of soils as one mapping unit and call it a soil complex. Ordinarily, a soil complex is named for the major kinds of soil in it, for example, Josephine-Mariposa complex. Also, on most soil maps, areas are shown that are so rocky, so shallow, or so frequently worked by wind and water that they scarcely can be called soils. These areas are shown on a soil map like other mapping units, but they are given descriptive names, such as Placer diggings and Riverwash or Rock land, and are called land types rather than soils.

While a soil survey is in progress, samples of soils are taken, as needed, for laboratory measurements and for engineering tests. Laboratory data from the same kinds of soils in other places are assembled. Data on yields of crops under defined practices are assembled from farm records and from field or plot experiments on the same kinds of soils.

But only part of a soil survey is done when the soils have been named, described, and delineated on the map, and the laboratory data and yield data have been assembled. The mass of detailed information then needs to be organized in a way that it is readily useful to different groups of readers, among them farmers, ranchers, managers of woodland, engineers, and homeowners. Grouping soils that are similar in suitability for each specified use is the method of organization commonly used in the soil survey reports. Based on the yield and practice tables and other data, the soil scientists set up trial groups, and test them by further study and by consultation with farmers, agronomists, engineers, and others. Then, the scientists adjust the groups according to the results of their studies and consultation. Thus, the groups that are finally evolved reflect up-to-date knowledge of the soils and their behavior under present methods of use and management.

General Soil Map

After study of the soils in a locality and the way they are arranged, it is possible to make a general map that shows several main patterns of soils, called soil associations. Such a map is the colored general soil map in the back of this report. Each association, as a rule, contains a few major soils and several minor soils, in a pattern that is characteristic although not strictly uniform.

The soils within any one association are likely to differ in some or in many properties; for example, slope, depth, stoniness, or natural drainage. Thus, the general soil map does not show the kind of soil at any particular place but shows a pattern of soils, in each of which there are several different kinds of soils.

Each soil association is named for the major soil series in it, but as already noted, soils of other series may also be present. The major soils of one soil association may also be present in other associations, but in a different pattern.

The general soil map is useful to people who want a general idea of the soils, who want to compare different parts of a county, or who want to know the possible location of good-sized areas suitable for a certain kind of farming or other land use.

There are three main physiographic sections in the Amador Area: (1) Mountainous uplands; (2) Middle and lower foothills; and (3) Arroyo Seco pediment, alluvial terraces, and flood plains. One or more soil associations are in each physiographic section. The soil associations have been grouped principally on the basis of soil differences that are related to differences in parent rock.

Soils of the Mountainous Uplands

The mountainous uplands are deeply entrenched by streams that flow southwestward. On the north and south, they are bordered by deeply gouged river canyons. Their elevation ranges from 1,200 to more than 5,000 feet. Precipitation ranges from 30 to more than 45 inches; it increases with increasing elevation, and much of it falls as snow. The native vegetation was chiefly forests of conifers and hardwoods. The mountainous uplands occupy about 40 percent of the Area.

Three of the associations in Amador Area are in the mountainous uplands. Metasedimentary rocks of the Calaveras formation are dominant in this section, but there are smaller areas of volcanic conglomerate and of granitic rocks.

1. *Mariposa-Josephine-Sites association: Shallow to deep soils in material from metasedimentary rocks*

This soil association is on rolling hills, sharp parallel ridges, and narrow valleys in areas that are progressively more mountainous to the east. The terrain is marked by numerous small entrenched drainageways and creeks, but some smoother slopes adjoin the wide flats and valleys. Elevations are more than 1,200 feet. A typical view is shown in figure 2. This association covers about one-fourth of the Area.

The vegetation in the lower transitional zone is commonly brushy, but it includes mixtures of blue and black oaks, scattered pines, and fairly large open areas of grass. Near elevations of 2,500 feet, ponderosa pines and black oaks predominate and the understory is brush, grass, and other plants. Good stands of conifers begin at elevations of about 3,500 feet, but fairly large stands are in pockets at lower elevations.

The soils in this association formed in material from uplifted, bedded, metamorphosed sediments, mainly of slate and schist but partly of limestone with fairly large inclusions of intrusive igneous rocks. In some places the ridges are capped with thin deposits of gravelly alluvium.

Because of the nearly vertical uplifting of the paren rock and its mixed mineralogy and varying degrees of metamorphism, these soils are fairly variable within horizontal distances of less than 50 feet. The soils range from shallow to very deep over bedrock. They are generally very rocky or gravelly silt loams or loams and are acid. Their fertility is somewhat lower in comparison with soils that also formed under forest but from other kinds of rock.

This association consists mainly of Mariposa, Josephine, and Sites soils, but it includes minor areas of Fiddletown, Maymen, Tiger Creek, and other soils. A fairly large acreage consists of Rock land.

The Mariposa soils are commonly on narrow ridge crests and overlie the tilted ends of rock strata. These soils are shallow and very rocky or gravelly. Their surface layer is pale brown, yellowish brown, or grayish brown and is loamy. Their subsoil is commonly slightly finer textured than the surface soil and is yellowish brown to yellowish red.

Generally, the Josephine soils are moderately deep,

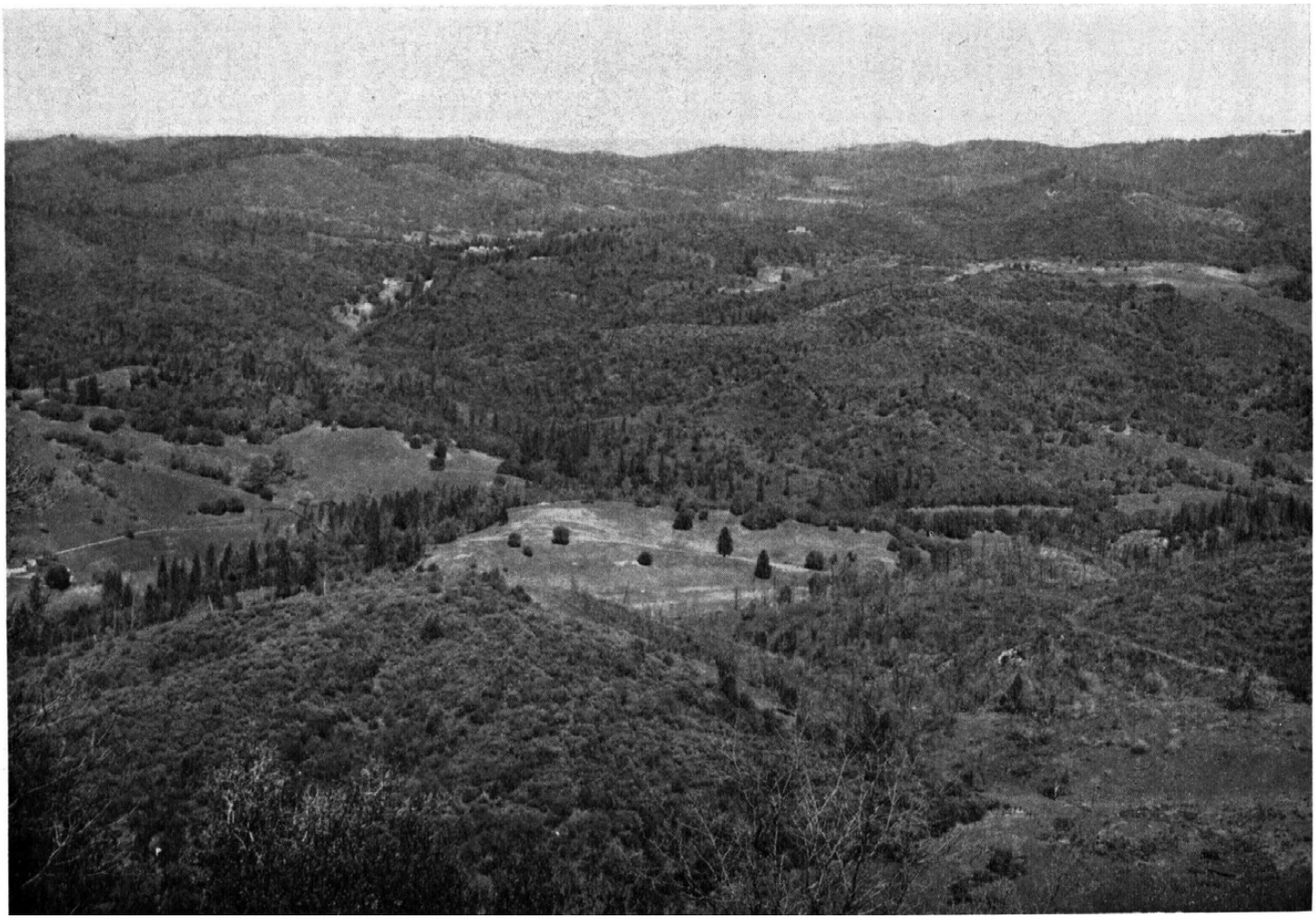

Figure 2.—**Typical view of the soils in the Mariposa-Josephine-Sites association at an elevation of slightly more than 1,200 feet.**

reddish-brown to yellowish-red rocky loams or silt loams. Their subsoil is brown, reddish-yellow, or red silty clay loam or clay loam.

The Sites soils are moderately deep and deep. They have a brown or reddish-brown loamy surface layer and a subsoil of red, reddish-brown, or yellowish-red clay.

This association is used mainly for timber and grazing. Most areas have been logged in the past, and the present stands consist of regrowth. The Josephine soils are more productive of timber than the Mariposa, because they are deeper and have a greater moisture-holding capacity. Sites soils are nearly as productive of timber as the Josephine soils.

In general, the soils in this association are too rocky and steep for cultivation. Also, the kinds of crops that can be grown are somewhat limited by the climate and the lack of irrigation water. The deeper, rock-free areas on gentler slopes are suited to apples, pears, grapes, hay, grain, pasture, and other crops suited to the climate. Farming across the slope, mulching, growing cover crops, and using other suitable practices help to control erosion.

2. *Musick-Holland association: Deep and moderately deep soils in material from granitic rocks*

This soil association is somewhat rolling and smooth and is generally at elevations of more than 1,600 feet. The hills are rounded, but areas that adjoin river canyons are steep and, in some places, precipitous and generally very rocky. The soils formed mainly in material from granodiorite, but partly in material from granite, quartz-diorite, and syenite. The vegetation is a typical conifer-hardwood forest. This association makes up less than 5 percent of the Area. The largest area is southeast of Pine Grove along the Mokelumne River, but small areas are east of Jackson and near River Pines.

In this association the Musick and Holland soils are predominant, but a small acreage consists of Shaver soils. A fairly large acreage consists of Rock land.

The Musick and Holland soils are commonly very rocky, micaceous, porous, and very deep. The Musick soils are brown or reddish-brown sandy loams or loams. Their subsoil is red or yellowish-red clay loam or clay. The Holland soils are light brownish-gray to grayish-brown coarse sandy loam, and their subsoil is light yellowish-brown to brown sandy clay loam.

This association is used mainly for timber. In many places rock outcrops restrict cultivation, and in some places steep slopes limit the use of these soils to timber. Cleared areas are grazed or cropped to hay and grain in places, and a small acreage is planted to vineyards or to orchards of walnuts and apples.

The soils in this association are well suited to timber, and, under good management, trees on them grow rapidly and are well formed. Regeneration of trees is good. There is little old-growth timber on these soils. Most areas have been cut over, and the trees are predominantly second and third growth. If the soils are cultivated or left unprotected, they erode readily.

3. *Aiken-Cohasset association: Very deep, deep, and moderately deep, cobbly soils in material from volcanic conglomerate*

Areas of this association are forest covered and are at elevations of more than 2,000 feet. The soils formed in material from cobbly andesitic mudflows of the Mehrten formation, which covers older rock formations. Only remnants of this once extensive mantle remain, and these are principally on flat, tabular ridges. The parent material consists of layers of cobbly conglomerate, sandstone, and siltstone. Near the Dew Drop Ranger Station and eastward, the material is more brecciated or massive. Conifers, oaks, brush, and other plants make up the vegetation. This soil association makes up less than 10 percent of the Area.

Dominant in the association are the Aiken and Cohasset soils. Minor areas consist of Iron Mountain, McCarthy, and Windy soils. A fairly large acreage of Rock land occupies areas on ridges.

The Aiken and Cohasset soils are cobbly, moderately deep to very deep, very friable, and acid. The Aiken are deep to very deep, dark-brown or reddish-brown loamy soils. Their subsoil is yellowish-red to red clay. The Cohasset soils are moderately deep to deep. They are similar to the Aiken soils in appearance but have less clay in the subsoil.

This association is used mostly for growing timber and for summer grazing. A small acreage of Aiken and Cohasset soils is planted to small orchards of apples and walnuts, mostly for family use. Nearly all forests have been logged at least once, and second-growth stands of timber predominate. In most areas forest regeneration is good, but the McCarthy and Iron Mountain soils at lower elevations are commonly brushy. Cleared areas on gentle slopes are used for pasture or cropped periodically to hay and grain. Similar soils in adjacent El Dorado County are used for orchards of pears and apples, but most areas in the Amador Area are largely undeveloped because irrigation water is lacking. If these soils are well managed, they produce rapid-growing stands of timber of high quality. If the soils are used for crops, adequate vegetation should be kept on them or practices that control erosion should be applied. Generally, cobblestones and other stones hinder cultivation.

Soils of the Middle and Lower Foothills

The middle and lower foothills consist of rolling to steep hills with conspicuous peaks and ridges, of mesalike plateaus with steep to sloping sidehills, and of gently undulating flats and valleys. Elevations range from 200 to 2,500 feet. The average annual rainfall is 20 to 40 inches. The middle and lower foothills make up about 40 percent of the Area.

There are three soil associations in the middle and lower foothills. The soils in these associations formed in material from metasedimentary slate and schist, from metabasic igneous rock, from granitic rock, and from volcanic conglomerate. Grass, grass-oak, brush, and scattered conifers make up the vegetation.

4. *Auburn-Exchequer association: Very shallow to moderately deep, rocky or gravelly soils in material from metabasic rocks and metasedimentary slate and schist*

The soils in this association are partly smooth and rolling, but they are progressively more steep and dissected toward the east. Most of the areas are in a wide band that extends northward from the Mokelumne River to the Cosumnes River. Elevations range from 200 to

2,000 feet. Streams have entrenched in a dendritic pattern, and those areas adjacent to major rivers and creeks are commonly steep to very steep. A large acreage north of Plymouth on the Logtown Ridge is steep and mountainous. Gently sloping flats occur in some places near Plymouth and Forest Home. Rock outcrops are common. Typically, the vegetation consists of grass-oak woodlands, of narrow areas of brush, of open areas of grass, and of some scattered digger pines (fig. 3). This

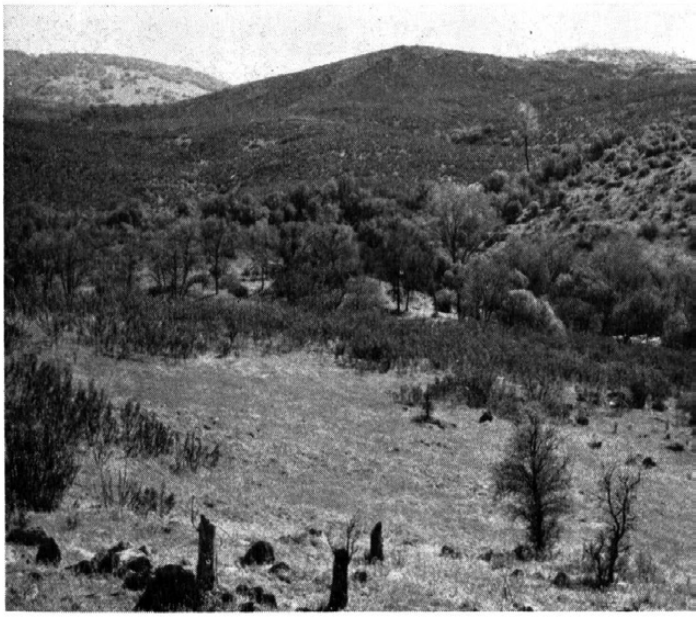

Figure 3.—**Typical vegetation on soils of the Auburn-Exchequer association.**

is the largest soil association in the Amador Area, and it occupies about one-third of the acreage.

The Auburn and Exchequer soils are dominant in this association. Minor areas consist of Argonaut and Henneke soils and of areas of Rock land and of Serpentine rock land.

The Auburn and Argonaut soils formed mainly in material from metabasic rock (including meta-andesite, commonly called greenstone or diabase), amphibolite and chlorite schist, porphyrite, and quartz, but partly from metamorphosed conglomerate, gabbro, and serpentine. In some places rock outcrops have the appearance of slate and stick out above ground like tombstones. Exchequer soils formed dominantly in material from metamorphosed sediments of slate and schist of the Calaveras and Mariposa formations with minor intrusions of igneous rock.

The Auburn and Argonaut soils in this association are very rocky or gravelly loams and silt loams. These soils have a brown, strong-brown, or yellowish-red surface soil and a yellowish-red subsoil. Depth to bedrock ranges from 10 to 30 inches. The subsoil of the Auburn soils is heavy loam, silt loam, or light clay loam, and has only a slight increase in clay content in comparison to its surface soil. Argonaut soils have a subsoil of yellowish-red clay that is sticky and very plastic. A large acreage of Auburn and Argonaut soils occurs in areas that are too intermixed to be mapped separately, and they are mapped together as a complex in the detailed survey.

Exchequer soils are somewhat excessively drained, very rocky, very shallow soils that have a cover of brush. These soils are dark brown or brown and range in depth from 6 to 18 inches.

The Henneke soils, which also are brush covered, are very rocky and very shallow. These soils formed in material from serpentine. They are dark reddish brown in color and 2 to 12 inches in depth.

Rock outcrops and nearness of bedrock to the surface are the major limitations to cultivating the soils in this association. The areas are used mostly for grazing. The Auburn soils provide good range for cattle, and in some places for sheep and goats. A small acreage is in hay and grain, irrigated pasture, and wine grapes. The Exchequer and Henneke soils and the rocky areas have little value for grazing. They are used mainly as protected watershed or as browse areas for wildlife.

On the Auburn and Argonaut soils, wooded areas can be made more productive by thinning stands of oak and thickets of brush. On the Exchequer soils, control of brush is a problem. Deteriorated range can be improved by seeding more productive grasses and legumes. Forage plants and crops on this soil respond if fertilizer that contains nitrogen and phosphate is applied. If these soils are well managed, yields of usable forage are high.

5. *Supan-Iron Mountain association: Very deep to shallow, cobbly or stony loams in material from volcanic conglomerate*

The soils in this association are on nearly flat, tabular ridges and on steep sidehills. They are mainly in the central part of the county between the towns of Jackson and Amador City. Smaller areas are between State Highways Nos. 49 and 104 near Horse Creek and near River Pines in the north. The vegetation is mostly grass-oak, brush, and scattered digger pines. The brush is thickest on the shallow Iron Mountain soils. This association makes up less than 5 percent of the Area.

The parent material consists of bedded layers of cobbly conglomerate, siltstone, and sandstone. It is part of the same formation that gives rise to soils of the Aiken-Cohasset association, which are at higher elevations.

In general, the soils in this association are dark-brown or reddish-brown cobbly or stony loams. They are friable and are mostly slightly acid in the surface soil and medium acid in the subsoil.

Supan soils are moderately deep or very deep and have a subsoil of reddish-brown to yellowish-red clay loam. Iron Mountain soils are shallow, very stony, dark grayish-brown or dark-brown loams, and they show little change in the profile with increasing depth. They are in the same general area as some areas of Rock land and are only a little better in quality.

Stones and steep slopes restrict the use of the soils in this association. As a result, the soils are used principally for range. The deeper Supan soils have been cultivated in some places, and the stones removed by hand. In these places the soils are planted to hay, grain, and vineyards, and they are fairly productive. Except for a small acreage in vineyards, most other areas have been left idle and have reverted to range. Some areas are cleared of brush and trees to increase yields of forage. A small acreage is used for homes, for the county airport, and for reservoirs that store water for domestic use.

6. *Sierra-Ahwahnee association: Deep and moderately deep, gritty sandy loams or loams in material from granitic rocks*

In this association the topography is mostly smooth and rolling, but steep breaks drop to river canyons, minor streams, and drainageways, and a few prominent peaks stand out. The areas are mainly north of Amador City and extend to the county line. Elevations range from 1,000 to 2,500 feet. This association makes up about 5 percent of the Area.

These soils formed mainly in material from granodiorite, but partly from granite and quartz diorite. The surface is commonly broken by outcrops of granitic rock. Grass-oak, scattered conifers, and brush make up the vegetation. Ponderosa pine becomes more abundant with increasing elevation, especially on north slopes and in protected areas.

The Sierra and Ahwahnee soils are dominant in this association, but minor areas consist of Snelling and Shenandoah soils. Also in this association are areas of Rock land.

The principal soils in this association are brown or yellowish-red gritty sandy loams or loams. They are porous, micaceous, and mostly medium acid.

The Sierra soils have a surface layer of brown or yellowish-red sandy loam or loam, and their subsoil is yellowish-red to red heavy loam or clay loam. They range from 20 to more than 60 inches in depth.

Ahwahnee soils are moderately deep, brown loams or fine sandy loams that have a slightly finer textured, brown or light reddish-brown subsoil.

The Snelling and Shenandoah soils are moderately well drained to somewhat poorly drained and are in concave swales and drainageways. They are brown, pale-brown, or brownish-gray soils.

The soils of this association are used mainly for grazing by cattle, sheep, and goats, and yields of usable forage are good if the soils are well managed. Trees from timbered areas are harvested and used for wood products. These soils, however, particularly the Sierra soils, make up a substantial part of the limited acreage used for crops in the Area. Some areas are planted to hay, grain, wine grapes, walnuts, and pasture.

The soils in this association are particularly susceptible to water erosion. Some areas have been cropped in the past and poorly managed and are now severely eroded. Practices that help protect the soils from erosion are farming across the slope, growing cover crops, controlling weeds by use of chemicals, stubble mulching, controlling irrigation and runoff water, and using other good management. At present most crops are grown without irrigation because little water is available for irrigating. On some farms water is stored in small reservoirs, but it is used mostly to irrigate pasture. Plans are being made, however, to obtain water from the Cosumnes River for irrigating.

Soils of the Arroyo Seco Pediment, Alluvial Terraces, and Flood Plains

This physiographic region consists of dissected terraces and escarpments, of rolling rounded hills, of tabletop buttes, and of nearly level valley bottoms and stream terraces. The Arroyo Seco pediment is an old eroded surface, upon which material from the Sierras was deposited. Most of the alluvium is on terraces in the Jackson and Ione Valleys. Elevations in this physiographic region range from 250 to 500 feet. The average annual rainfall is 20 to 25 inches. Grass, grass-oak, brush, and scattered digger pines make up the vegetation. The soils in this physiographic region occupy about 20 percent of the Area.

Two of the soil associations in the Amador Area are in this physiographic region. Small areas of Placer diggings and Riverwash and of Mine tailings and Riverwash are also in this physiographic region.

7. *Pentz-Pardee association: Very shallow to moderately deep soils in material from rhyolitic tuff, gravelly alluvium, marine clay, sandstone, and volcanic conglomerate*

In this soil association the topography consists of tabletop plateaus, dissected terraces, and rolling hills interspersed with small valleys and hummocky flats. It occupies a tract in the lower foothills of the Area extending from Ione to the western boundary of the county. The tract is 4 to 6 miles wide. Roughly, its length reaches from the Mokelumne River northward nearly to Little Indian Creek. The vegetation is mostly grass-oak, scattered digger pines, and brush. This association covers a little more than 10 percent of the Area.

The parent material of the soils in this association is fairly variable and, in many places, mixed. It consists of gravelly alluvium brought down from the Sierras because of geologic erosion, of volcanic debris carried in flows of mud and ash, and of sand and clay deposited in the quiet waters of an ancient inland sea.

The principal soils of this association are the Pentz and Pardee. Also extensive are soils of the Mokelumne complex, areas of Inks loam and Rock land, and the Laniger soils. Minor areas consist of Mokelumne, Inks, and Peters soils. Areas of Rock land, Sedimentary rock land, Placer diggings and Riverwash, and Mine tailings and Riverwash, together with areas where mining is done, make up about one-half the acreage of this association.

The Pentz soils formed in material from rhyolitic tuff. They are very shallow to shallow, light brownish-gray to pale-brown sandy loams. Their subsoil is light brownish gray and is strongly acid. Laniger soils are moderately deep, but they are otherwise similar to the Pentz soils.

The Pardee and Perkins soils formed in material from reddish-brown gravelly alluvium. These soils are brown or reddish-brown gravelly loams. Their subsoil is reddish-brown or red clay loam or clay. Depth to cemented gravel ranges from 12 to 50 inches, and it varies widely from place to place.

Generally, areas of the Red Bluff and Mokelumne soils are intermingled, and they are therefore mapped together as a soil complex. The Red Bluff soils are reddish-brown or yellowish-red gravelly loams. Their subsoil is red or dark-red clay or clay loam that is very strongly acid to extremely acid. Red Bluff soils formed in gravelly alluvium that mantled or interbedded areas of sandstone and clayey marine sediments. Mokelumne soils formed in material from these sediments. They are grayish-brown to light yellowish-brown sandy loams or loamy coarse sands and are medium acid to strongly acid. Their subsoil is pale-brown, reddish-brown, or yellowish-brown sandy clay, clay, or silty clay that is very firm and is strongly acid to

extremely acid. Generally, the Mokelumne soils are on concave slopes and in depressions in the lower parts of foothills.

The Inks and Peters soils are fairly inextensive. They formed in material from volcanic sandstone, tuff, and conglomerate. Inks soils are moderately deep, brown or dark-brown loams that have a subsoil of light clay loam. Peters soils are dark grayish-brown or dark-gray clay. They are nearly black when moist and have splotches of pale yellow in the subsoil.

The undifferentiated unit of Inks loam and Rock land consists of very cobbly, very shallow soil material interspersed between areas of Rock land and gravelly reddish-brown soil material.

Most of the soils in this association are of limited use for crops because of rock fragments in the profile, nearness of bedrock to the surface, steep slopes, low fertility, or strong acidity. The areas are used chiefly for grazing. Yields of forage vary widely, but they are generally poor. A fairly large acreage has a cover of dense brush. It is used as protected watersheds, as browse areas for wildlife, or for mining. In some places the moderately deep Laniger, Mokelumne, Red Bluff, and Inks soils are periodically cropped to improved pasture or to hay and grain. Yields are fair to poor, unless large amounts of fertilizer are applied. On the Perkins soils, barley, oats, milo, and corn produce fair yields; a small acreage is also planted to wine grapes. These crops on the Perkins soils respond well if fertilizer that contains nitrogen and phosphate is applied.

8. *Honcut-Snelling-Ryer association: Very deep and deep, medium-textured soils in alluvium; on stream terraces and flood plains*

The soils in this association are in the western part of the county. They are on gently sloping valley bottoms, flood plains, and stream terraces or on nearly level benches and gently rolling to hilly terraces. These soils are deep or very deep. They are mostly well-drained alluvial soils. Elevations range from 250 to 400 feet. The average annual rainfall is 20 to 25 inches. The association occupies less than 10 percent of the Area, but it makes up a large part of the acreage used as cropland. It includes some of the best agricultural soils.

The Honcut, Snelling, and Ryer soils are the principal soils in this association. Small areas of Loamy alluvial land and of Mixed alluvial land, which occur in small stringers along creeks and streams throughout the county, are also in this association.

Honcut soils formed in predominantly basic, recent alluvium deposited mainly on bottoms and flood plains in the Jackson and Ione Valleys and on stream terraces. These soils are nearly level to gently sloping and are in the southwestern part of the Area. Except for minor depressions in drainage swales, their topography is smooth. The soils are mostly well drained, but in places they are moderately well drained.

The Snelling soils are mainly in the southwest corner of the Area adjacent to the Mokelumne River and perched on small hills along the western boundary of the county. These soils occupy nearly level benches and gently rolling to hilly terraces. They formed in granitic alluvium that caps older formations. Much of the acreage of the Snelling soils is behind the proposed dam at Camanche and will be inundated by water.

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Ryer soils formed in material similar to that of the Honcut soils and occupy similar positions. They are, however, in the northwestern part of the area and are very deep, yellowish-brown silty clay loams. Their subsoil is extremely hard and dense.

The principal soils in this association are sandy loams, fine sandy loams, and silty clay loams. A small acreage of the Honcut soils, however, consists of silt loams or clay loams. Most of the soils are stratified, generally with finer-textured material, but in places with sand and gravel. Except for the Ryer soils, which have a surface layer that is medium acid and a subsoil that is medium acid to neutral, these soils are slightly acid to neutral in the surface soil and slightly acid, neutral, or mildly alkaline in the subsoil. Generally, fertility is moderate to high, but in the Ryer soils it is moderate to low. In some places adjacent to creeks, the soils are subject to flooding.

Much of the acreage of this association is cropped. Undeveloped or idle areas are used for range in places. The plants on the range are mostly soft chess, filaree, wild oats, annual clover, fescue, foxtail, mustard, wild radish, and other annual grasses and forbs. Cottonwood, alder, willow, and poplar trees are generally along the drainageways. A few large white oaks are in the valley bottoms, and scattered blue oaks and live oaks are on the bottoms and terraces.

The Honcut soils are some of the best soils in the Area. They are used for alfalfa, irrigated pasture, milo, corn, dry beans, wheat, barley, and oats; undeveloped areas are used for range. The Snelling soils are used for grazing, hay, grain, wine grapes, and small deciduous orchards planted for family use. Ryer soils are used mostly for grazing, but a small acreage is planted to hay and grain.

The soils in this association are productive if they are well managed. Some wet areas along stream channels require artificial drainage or protective levees in places. Alfalfa and clovers on these soils respond if fertilizer that contains phosphate is applied and if sulfur is added occasionally. The crops and range plants on these soils respond if fertilizer that contains nitrogen and phosphate is applied.

Shortage of irrigation water is a major problem in the development and use of these soils.

Use and Management of the Soils

In this section facts about agriculture and land use in the Area are given and general management suitable for the soils is described. Then the capability grouping used by the Soil Conservation Service is explained and suggestions for managing soils in each capability group are given. Following this, the Storie index rating for each of the soils and the relative suitability of the soils for the principal crops in the Area are given. After that, range management is discussed and soils with similar forage potentials are grouped into range sites. Woodland management is then described and suitable practices for and the potentials of soils for forestry are given. This is followed by a discussion on use of the soils for wildlife. Last is a discussion of engineering interpretations of the soils.

Agriculture

Tribes of Digger Indians, mainly the Miwoks, originally lived in this part of California (*11*).[1] Later, the early Spanish settlers tried to use large tracts of rangeland in the lower foothills for grazing cattle, but the herds were repeatedly raided by Indians who took the animals for their own use. Thus, these attempts to raise cattle were largely unsuccessful.

As early as 1820, fur traders were in the Area. In 1846, Capt. John Sutter, a few other white men, and a group of Indians came into the Area to cut timber for a ferry boat. The timber was taken from a ridge near what is now the town of Sutter Creek. After gold was discovered in 1848 in Coloma 45 miles to the north, prospectors swarmed over the Area to work the rich placer deposits in the creeks (*16*). By 1860, the placers were yielding large sums, and quartz mining provided permanent work. Provisions were needed for the settlements, and agriculture therefore offered a profitable way for many of the settlers to make a good living.

The soils in the Area were fertile and productive. The grass on the range was as high as a horse's back. Water flowing through the extensive network of canals needed for surface mining was used by the farmers to improve yields.

In 1860, according to the County Assessor's report, 600 miles of main canal ditches supplied water to most of the Area in the foothills; more than 10,000 acres was planted to hay, wheat, barley, corn, fruit trees, and grapevines. In addition, 15 sawmills cut 11½ million feet of lumber in that year, and 32 quartz stamp mills crushed nearly 61,000 tons of ore.

At the California State Fair in 1889, farmers from Amador County exhibited peaches, apples, plums, prunes, grapes, oranges, limes, lemons, nectarines, pomegranates, figs, grapes, currants, hickory nuts, walnuts, and butternuts. They also had exhibits of wheat, barley, rye, oats, corn, hops, tobacco, and potatoes and other vegetables. By this time an agricultural experiment station had been established near Pine Grove and deeded to the University of California (*22*).

Returns from placer mining had dwindled by 1900, and tales of new strikes of gold in Nevada and Alaska attracted many miners away from the Amador Area. Nevertheless, agriculture continued to thrive for a time, and vineyards and orchards on hillsides were fed by water from former mining ditches. This area had become the richest producing section in the Mother Lode Gold Belt (*7*), and quartz mining continued until 1942, when most of the active mines closed.

Agricultural enterprise gradually declined. The extensive system of mining ditches that also furnished water for agriculture was neglected. Some of the ditches fell into disrepair; others were sold to power companies for development of hydroelectric power. Improvements in transportation by road and rail allowed provisions to be brought into the Area from the Central Valley where farm products could be more easily produced. Periods of depression and drought, and the increasing costs of production, gradually forced abandonment of many of the hillside orchards and vineyards. In addition, much of the fertile soil on the bottom lands was dredged or littered with mining debris. Soils on hillsides that were in crops reverted to range, or brush encroached on them. Most of the soils in timber were cut over at least once. Now, only a few areas of virgin timber remain in private holdings.

Agriculture in the Amador Area today is based largely on the raising of livestock and on forestry. The use of many of the soils for crops is limited because the soils are steep, rocky, and shallow over bedrock. Also, water for irrigation is scarce. As a result, according to the Amador County Agricultural Commissioner's report, only about 2 percent of the Area is used for cultivated crops. About 50 percent of the Area is grass-oak range, and the rest is made up of brushy areas and of forests that also provide some forage for livestock. Commonly, the forests consist of conifers and hardwoods.

The climate in the Area is suitable for growing a wide variety of crops. Danger of frost in winter, however, makes the growing of frost-sensitive fruits uncertain. Because water for irrigation is scarce, crops generally are dry-farmed.

The rolling foothills are used mostly as range for beef cattle, but in some places they are grazed by sheep, goats, dairy cattle, swine, and poultry. Throughout the foothills wild hay is cut from a large acreage.

The soils used for crops are mostly in two areas. One is in the Ione and Jackson Valleys in the southwestern part of the Area. It is made up of alluvial soils along Jackson, Sutter, and Dry Creeks. The other is in the uplands near Plymouth in the Shenandoah Valley where the parent rock is granitic.

In the Ione and Jackson Valleys, dry beans, corn, alfalfa, pasture plants, sorghum, and a small acreage of walnuts are irrigated; barley, oats, vetch, improved pasture, and a small acreage of wheat are dry-farmed. In the Shenandoah Valley, barley, oats, wheat, pasture plants, vetch, wine grapes, walnuts, prunes, and a few acres of peaches, chestnuts, olives, and filberts are mostly dry-farmed. Small, isolated areas of arable soils scattered throughout the Area are planted to similar crops.

Some cleared areas of timberland are planted to apples, walnuts, grapes, hay, and grain or are used for pasture. Commercial stands of timber are largely at elevations of more than 2,000 feet, but small areas of trees are in pockets of soil at lower elevations. The forested areas provide summer range for livestock.

Crops

The main crops that are grown in the Area are discussed in the paragraphs that follow. The statistics are for the year of 1960 and are compiled from the Amador County Agricultural Commissioner's report.

Pastures.—Dryland pastures provide the most effective ground cover for stabilizing the soils and are capable of yielding large quantities of forage.

There were 902 acres of irrigated pasture in the Area in 1960, and 165,000 acres of dry range.

Annual plants are best suited to the moist, cool winters and hot, dry summers of the Area. They germinate late in fall or early in winter when the rains come are green in winter and early in spring, and dry up and go to seed late in spring. If allowed to go to seed, annual plants are self perpetuating. The rangeland in the foothills provides green feed, in most years, from November through May, and hay is cut in many places from the gentler slopes

[1] Italic numbers in parentheses refer to Literature Cited, page 159.

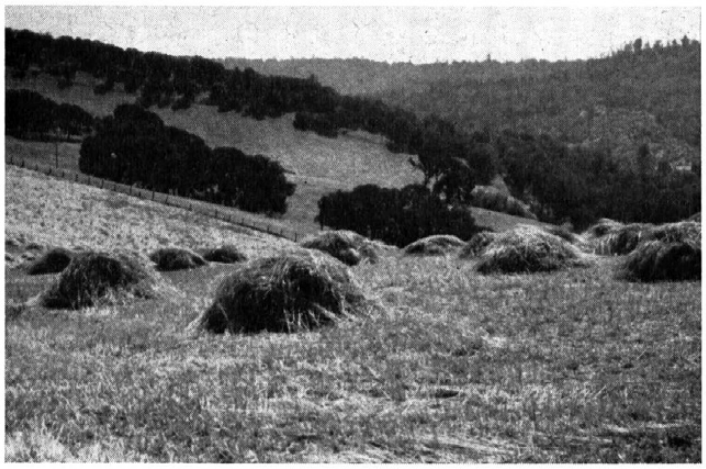

Figure 4.—**Annual grasses cut for hay on Auburn soils.**

(fig. 4). Specific information on management of range is given in the section "Range Management."

In places where irrigation water is available, a fairly large acreage is used for improved pasture of grasses and legumes. Sudangrass is used for summer pasture and as a cover crop.

Field crops.—About two-thirds of the acreage of the cropland in the Area is used for field crops, and the largest part is used for small grains grown for hay. Oats, vetch and oats, alfalfa, and some barley are the main hay crops. Barley, oats, sorghum, and minor acreages of corn and wheat are grown for grain. Corn is cut for silage. Table 1 shows the acreage of principal field crops and total production in the Amador Area in 1960.

TABLE 1.—*Acreage and total production of principal field crops in 1960*

Crop	Acreage harvested	Total production
		Tons
Barley	335	405
Beans, dry	348	282
Corn for silage	108	907
Cut for hay:		
Alfalfa	387	1,320
Small grains	1,150	2,070
Other	769	1,230
Oats	181	125
Sorghum for grain	325	694
Wheat	132	117

In most places the fields are planted in fall after the first rains. Small grains are drilled or broadcast and harrowed. They are generally harvested mechanically in July or August.

Yields of cereals are not particularly high. Many of the soils planted to these crops have been farmed for many years, and erosion and lowered fertility are the main causes of reduced yields. Applying commercial fertilizers is not a common practice.

Alfalfa hay is grown in some places in the area of Ione and Jackson Valleys. It is grown under irrigation and mostly on Honcut soils. Barley, oats, corn, and in some places wheat, is also grown on these soils. Sorghum for grain is grown mostly in the Jackson Valley on Perkins and Honcut soils. The oats, barley, and wheat are grown mainly in the Shenandoah Valley on Ahwahnee, Sierra, and other granitic soils.

Truck crops.—A few truck crops are grown commercially in the Jackson and Ione Valleys. Tomatoes and dry beans are grown under irrigation on the bottom lands on soils of the Honcut series. In 1960, 220 tons of fresh vegetables was reported as harvested from 44 acres.

Fruit and nut crops.—The chief fruit and nut crops grown are wine grapes, walnuts (fig. 5), prunes, apples,

Figure 5.—**Walnut orchard on a Sierra coarse sandy loam. Light disking between the rows has left the soil rough and cloddy.**

and peaches. A small acreage is in chestnuts, olives, and filberts. The acreage of the principal fruit and nut crops in 1960 and their total production are shown in table 2. The figures are for trees of bearing age.

Walnuts, grapes, prunes, and peaches are dry farmed. They are grown mainly in the Shenandoah Valley and in the Fiddletown area. A small acreage of apples is grown near Pioneer. The orchards are small, generally less than 15 acres; yields vary and are not high. About one-thousand acres is in orchards and vineyards. A winery near River Pines processes the grapes grown locally.

TABLE 2.—*Acreage and total production of fruit and nut crops*

Crop	Acreage	Total production
		Tons
Apples	34	9.9
Wine grapes	572	972.0
Peaches, dried	10	2.9
Prunes	105	68.3
Walnuts	221	59.7
Miscellaneous (chestnuts, olives, filberts, etc.)	44	(1)

[1] Not available.

Livestock and livestock products

Livestock and livestock products are an important source of income in the Amador Area. Cattle, hogs, sheep, goats, and poultry are the chief kinds of livestock. The main kinds of livestock and their number in the Area in 1960, according to the Amador County Commissioner's report, are as follows:

	Number
Cattle	9,720
Hogs	1,378
Sheep	5,804
Goats, Angora	960
Poultry	171,300

Whole milk and butter are the most important dairy products. Cattle, hogs, sheep, and poultry were sold live from many of the farms. In addition, 424 thousand dozens of eggs were sold from the farm in 1960. Also, 4.8 tons of mohair and 20.4 tons of wool were sold, and about 8.5 tons of honey.

Important Practices for the Amador Area

This subsection describes cropping practices suitable for the soils of the Amador Area. These include conservation cropping systems, farming across the slope, growing of cover crops, stubble mulching, and chemical control of brush.

Conservation cropping systems.—A conservation cropping system consists of growing different crops in sequence or of rotating crops with pasture to avoid depleting the soils. If cereal grain and grain hay, or similar crops, are grown on the same fields year after year, the plant nutrients and content of organic matter are lowered. This practice brings about a gradual deterioration of soil friability and tilth. Other crops besides grain and hay in rotation are needed to maintain soil organic matter, fertility, and soil structure, and also to aid in controlling weeds, diseases, and insects.

Legume and grass pasture plants can be grown in rotation with grain and hay crops. Pasture plants are close growing, and they have beneficial effects on the soil. They add organic matter and nitrogen, especially if residues are returned to the soil. The extensive root systems improve soil structure and tilth. These soil improvements, in turn, improve yields of the hay and grain crops and are especially helpful on the Honcut, Ryer, Snelling, and Sierra soils, which are the most arable soils in the Area.

Rotating crops also aids in controlling weeds. Cutting annual weeds close to the ground before their seed ripens will reduce revegetation. Several opportunities to do this occur in the rotation of row crops, grain, and pasture plants. Most of the noxious weeds are perennials, however, and control of them is more difficult.

Conservation cropping systems and the time sequence of rotations vary with slope and other limitations of the soils. Cropping systems for soils in different capability units are discussed in the section "Management by Capability Units."

Cross-slope farming.—Cross-slope farming is farming in such a way that plowing, planting, and other field operations are done at right angles to the direction of slope. Its purpose is to prevent erosion on sloping soils that are cultivated. If furrows, tracks of tractors, and tracks of other machinery used for tillage are not made parallel to the slope, rivulet channels result. These channels speed up the velocity of runoff water. They soon become rills, then gullies, and cause serious erosion. Tillage across the slope provides catch basins for runoff and slows it down. This practice is easy to carry out and is invaluable in preventing erosion.

Growing of cover crops.—A soil is most susceptible to erosion if it is bare of vegetation during the rainy period. A soil low in organic matter is more easily eroded than one high in organic matter. If rain falls when the soil is bare, some erosion occurs, even if the slope is gentle. Also, sloping soils planted to orchards and vineyards and that are clean cultivated between the rows are very likely to erode unless protected by cover crops.

A cover crop is any crop that provides good ground cover, breaks the force of falling raindrops, and thus helps prevent erosion. The term is generally applied to those crops that are planted especially to check erosion and to add organic matter.

A green-manure crop is one that is grown to be plowed or otherwise worked into the soil.

The principal advantages of a cover crop are that it—

1. Reduces runoff of rain and conserves rainfall.
2. Prevents excessive erosion of the soil.
3. Improves soil tilth by adding organic matter to the soil and by loosening the subsurface of the soil with deep-growing roots.
4. Reduces leaching of plant nutrients, especially of nitrates.
5. When plowed under, aids in the liberation of mineral plant nutrients.
6. May provide pasture late in fall, in winter, and early in spring.
7. Protects newly constructed earthfills, terraces, or other structures.
8. Increases yields of grain, hay, and other crops in the farming system.
9. Increases the infiltration of water into the soil.

Stubble mulching.—Tillage that keeps crop residues on the surface and maintains a granular or cloddy surface soil is effective in conserving water and in helping to control erosion. Stubble mulching is one of the best ways to conserve soil and moisture during the fallow period, and to protect cropland during the period in which a seedbed is prepared for the succeeding crop.

Stubble-mulch tillage breaks the impact of raindrops by breaking each of them into many smaller droplets that can enter the soil without moving or splashing much of it. The impact of ordinary rain easily seals a soil that has weak structure, especially the surface soil of such soils as the Sierra, Ahwahnee, and Snelling. The practice is of particular importance in the management of these soils. While the stubble is decomposing, it uses a small amount of soil nitrogen. Some extra nitrogen may therefore be needed in the fertilizer.

Chemical control of brush.—About 69,000 acres, or nearly a fourth of the agricultural land in the Amador Area, is covered with brush or is subject to encroachment of brush. The principal species are chamise, manzanita, and ceanothus.

Chemical eradication, which kills the brush in place without cultivation, frees the soil for more productive use. After the brush has been killed, volunteer stands of soft chess, burclover, and wild oats produce good forage. In areas of heavy brush, burning and reseeding after

chemicals have been applied will generally produce excellent pastures. Some inaccessible areas have been sprayed from airplanes. Ground machines provide excellent control in places where they can be used. Brush control is considered economically feasible only on soils that are more than 10 inches deep.

Capability Groups of Soils

The capability classification is a grouping that shows, in a general way, how suitable soils are for most kinds of farming. It is a practical grouping based on limitations of the soils, the risk of damage when they are used, and the way they respond to treatment.

In this system all the kinds of soil are grouped at three levels—the capability class, subclass, and unit. The eight capability classes in the broadest grouping are designated by Roman numerals I through VIII. In class I are the soils that have few limitations, the widest range of use, and the least risk of damage when they are used. The soils in the other classes have progressively greater natural limitations. In class VIII are soils and landforms so rough, shallow, or otherwise limited that they do not produce worthwhile yields of crops, forage, or wood products.

The subclasses indicate major kinds of limitations within the classes. Within most of the classes, there can be up to four subclasses. The subclass is indicated by adding a small letter, *e*, *w*, *s*, or *c* to the class numeral, for example, IIe. The letter *e* shows that the main limitation is risk of erosion unless close-growing plant cover is maintained; *w* means that water in or on the soil will interfere with plant growth or cultivation (in some soils, the wetness can be partly corrected by artificial drainage); *s* shows that the soil is limited mainly because it is shallow, droughty, or stony; and *c* used only in some parts of the country, indicates that the chief limitation is climate that is too cold or too dry.

In class I there are no subclasses, because the soils of this class have few or no limitations. Class V can contain, at the most, only subclasses *w*, *s*, and *c*, because the soils in it have little or no susceptibility to erosion but have other limitations that restrict their use largely to pasture, range, woodland, or wildlife.

Within the subclasses are the capability units, groups of soils enough alike to be suited to the same crops and pasture plants, to require similar management, and to have similar productivity and other responses to management. Thus, the capability unit is a convenient grouping for making many statements about the management of soils. Capability units are generally identified by numbers assigned locally; for example, IIe–1 or IIIe–8.

Capability units in California are given numbers that suggest the chief kind of limitation responsible for placement of the soil in the capability class and subclass. For this reason, some of the units within the subclasses are not numbered consecutively, and their symbols are a partial key to some of the soil features. The numerals used to designate units within the classes and subclasses are these:

0. A problem or limitation caused by stony, cobbly, or gravelly material in streambeds subject to flooding.
1. A problem or limitation caused by slope or by actual or potential erosion hazard.
2. A problem or limitation of wetness caused by poor drainage or flooding.
3. A problem or limitation of slow or very slow permeability of the subsoil or substratum caused by a claypan or a substratum that is semiconsolidated.
4. A problem or limitation caused by low water-holding capacity.
7. A problem or limitation caused by rocks or cobblestones.
8. A problem or limitation in the root zone, which generally is less than 36 inches over massive bedrock and lacks moisture for plants.
9. A problem or limitation caused by low or very low fertility, acidity, or toxicity that cannot be corrected by adding normal amounts of fertilizer or lime.

In the capability units that end with a dual number, for example, 49, are soils that have limitations or problems of a dual nature that are about equally restrictive. The limitations in the example cited are caused by low water-holding capacity, as well as by low fertility that results from sandy texture, shallowness, and acidity.

Because of the diversity of climate, topography, vegetation, and general type of agriculture in the county, the Amador Area has been divided into two land resource areas, designated nationally as 18 and 22. Land resource area 18 consists of the lower and middle foothills, and land resource area 22 of the mountainous uplands. A soil in one resource area may have characteristics similar to those of a soil in the other resource area and have the same capability unit symbol, but the climate, vegetation, the kinds of crops that could be grown, and the use and management practices needed may vary widely. Consequently, the capability units of soils in the conifer forests of the mountainous uplands at elevations generally from 1,500 to 5,000 feet are designated by the symbol (22). The capability units in the rest of the Area below this general elevation are designated by the symbol (18). For example, both capability units IIIe–1(18) and IIIe–1(22) contain deep, well-drained soils, but unit IIIe–1(18) is in the middle or lower foothills and IIIe–1(22) is in the mountainous uplands.

Soils are classified in capability classes, subclasses, and units in accordance with the degree and kind of their permanent limitations, but without consideration of possible but unlikely major landforming projects.

The eight classes in the capability system, and the subclasses and units in this Area, are described in the list that follows:

Class I. Soils that have few limitations that restrict their use.

Unit I–1(18).—Very deep, well-drained, nearly level soils on flood plains, stream terraces, and valley bottoms.

Class II. Soils that have some limitations that reduce the choice of plants or require moderate conservation practices.

Subclass IIe. Soils that are likely to erode if they are not protected.

Unit IIe–1(22).—Deep to very deep, well-drained, gently sloping soils.

Subclass IIw. Soils that have moderate limitations because of excess water.
Unit IIw–2(18).—Imperfectly drained or moderately well drained, mostly nearly level soils in depressions in valley bottoms or in swales and drainageways.

Class III. Soils that have severe limitations that reduce the choice of plants, or require special conservation practices, or both.
Subclass IIIe. Soils subject to severe erosion if they are cultivated and not protected.
Unit IIIe–1(18). Deep, well-drained, undulating to gently rolling soils.
Unit IIIe–1(22).—Deep and very deep, well-drained, moderately sloping to strongly sloping soils.
Unit IIIe–3(18).—Deep, gently sloping to sloping soils that have a slowly permeable subsoil.
Unit IIIe–8(18).—Moderately deep, mostly gently sloping to sloping soils.
Unit IIIe–8(22).—Moderately deep to deep, mostly gently sloping to sloping soils.
Subclass IIIw. Soils that are severely limited by excess water.
Unit IIIw–3(18).—Imperfectly drained or moderately well drained, mostly nearly level soils that contain a slowly permeable layer or are moderately deep over bedrock.
Subclass IIIs. Soils that have severe limitations because of fertility, tilth, and permeability.
Unit IIIs–3(18).—Deep, nearly level soils that are moderate to low in fertility and have slow subsoil permeability.

Class IV. Soils that have very severe limitations that restrict the choice of plants, require very careful management, or both.
Subclass IVe. Soils very severely limited by risk of erosion if cultivated and not protected.
Unit IVe–1(18).—Deep, rolling, well-drained soils.
Unit IVe–1(22).—Deep, rolling to hilly, well-drained soils.
Unit IVe–3(18).—Shallow to moderately deep, gently sloping to moderately steep soils that are clayey or have a very slowly permeable clay subsoil.
Unit IVe–39(18).—Nearly level to rolling soils that have low to very low fertility and a slowly permeable subsoil.
Unit IVe–4(18).—Shallow, nearly level to rolling soils that have moderate to low water-holding capacity.
Unit IVe–8(18).—Predominantly strongly sloping, moderately deep, eroded soils.
Unit IVe–8(22).—Predominantly moderately steep, moderately deep, well-drained soils.
Unit IVe–84(22).—Gently sloping to moderately steep, shallow soils that have low available water holding capacity.
Subclass IVw. Soils very severely limited by excess water.
Unit IVw–2(18).—Alluvial soils and land types that are subject to flooding or have imperfect to poor drainage.
Unit IVw–2(22).—Mixed alluvial lands that are subject to flooding or have imperfect to poor drainage.
Subclass IVs. Soils very severely limited by cobblestones, other stones, and other unfavorable soil features.
Unit IVs–7(18).—Very deep, gently sloping to steep, well-drained soils.
Unit IVs–7(22).—Deep, gently sloping to strongly sloping, well-drained soils.

Class V. Soils that have limitations impractical to remove that limit their use largely to pasture, range, woodland, or wildlife food and cover.
Subclass Vs. Soils generally unsuited to cultivation because of cobblestones or rockiness.
Unit Vs–7(22).—Deep, gently sloping to strongly sloping, very cobbly or very rocky soils.

Class VI. Soils that have severe limitations that make them generally unsuited to cultivation and that limit their use largely to pasture or range, woodland, or wildlife food and cover.
Subclass VIe. Soils severely limited, chiefly by risk of erosion, by cobblestones or rock outcrop, or other soil features.
Unit VIe–1(18).—Rolling to hilly, moderately deep to deep soils.
Unit VIe–9(18).—Gently sloping to steep, moderately deep to shallow soils that have low to very low fertility.
Subclass VIs. Soils generally unsuited to cultivation and limited for other uses by moisture capacity, rockiness, cobblestones, or other soil features.
Unit VIs–1(18).—Rolling to hilly, very rocky, granitic soils.
Unit VIs–1(22).—Deep to very deep, hilly to steep, well-drained soils.
Unit VIs–4(18).—Shallow, gently sloping to hilly, very rocky soils that have moderate to low available water holding capacity.
Unit VIs–4(22).—Mostly shallow, very stony or very rocky soils that have low water-holding capacity.
Unit VIs–41(18).—Steep, mostly shallow soils that have moderate to low available water holding capacity.
Unit VIs–49(18).—Shallow, gently sloping to steep soils.
Unit VIs–8(18).—Moderately deep, gently sloping to hilly, very rocky or very cobbly soils.
Unit VIs–8(22).—Moderately deep, gently sloping to rolling, very cobbly or very rocky soils.
Unit VIs–81(18).—Moderately deep, steep, very rocky or very cobbly soils.
Unit VIs–81(22).—Moderately deep, hilly to steep, generally very rocky or very cobbly soils.

Class VII. Soils that have very severe limitations that make them unsuited to cultivation and that restrict their use largely to grazing, woodland, wildlife, or recreation.
Subclass VIIs. Soils very severely limited because they are stony, cobbly, or rocky and have low available water holding capacity.

Unit VIIs–1(18).—Rolling to very steep, moderately coarse textured or medium textured, very rocky, granitic soils subject to erosion.
Unit VIIs–1(22).—Deep, very steep, and very rocky or very cobbly soils.
Unit VIIs–4(18).—Very shallow, nearly level to very steep, generally very rocky or very stony soils.
Unit VIIs–4(22).—Very shallow, rolling to very steep, very rocky soils.
Unit VIIs–41(22).—Shallow, very steep, and very rocky soils.
Unit VIIs–7(18).—Moderately deep to shallow, rolling to very steep, extremely rocky soils.
Unit VIIs–81(22).—Moderately deep, hilly to very steep, very rocky or extremely rocky soils.
Unit VIIs–9(18).—Very shallow, very rocky soils that have very low fertility.
Unit VIIs–0(18 and 22).—Stony, cobbly, and gravelly material in riverbeds, mined areas, and placer diggings.

Class VIII. Soils and land types with limitations that preclude their use for commercial production of plants and restrict their use to recreation, wildlife, watershed, or to esthetic purposes.

Subclass VIIIs. Land types, mostly rock or rock fragments.

Unit VIIIs–8(18).—Mostly very shallow, extremely rocky land types with large areas of exposed bedrock.
Unit VIIIs–8(22).—Very shallow, extremely rocky or stony land types.

The acreage of each capability unit and the total acreage in each capability class are given in the list that follows:

CAPABILITY UNIT AND CLASS

	Acres		*Acres*
Unit I–1	3, 092	Unit VIe–1	1, 954
Total class I	3, 092	Unit VIe–9	5, 810
Unit IIe–1	1, 089	Unit VIs–1	28, 611
Unit IIw–2	1, 238	Unit VIs–4	59, 258
Total class II	2, 327	Unit VIs–41	11, 596
Unit IIIe–1	3, 677	Unit VIs–49	6, 423
Unit IIIe–3	560	Unit VIs–8	8, 209
Unit IIIe–8	5, 576	Unit VIs–81	30, 490
Unit IIIw–3	1, 076	Total class VI	152, 351
Unit IIIs–3	1, 355	Unit VIIs–1	7, 497
Total class III	12, 244	Unit VIIs–4	33, 020
Unit IVe–1	3, 211	Unit VIIs–41	5, 650
Unit IVe–3	874	Unit VIIs–7	3, 208
Unit IVe–39	8, 899	Unit VIIs–81	6, 452
Unit IVe–4	9, 775	Unit VIIs–9	2, 064
Unit IVe–8	5, 589	Unit VIIs–0	5, 278
Unit IVe–84	1, 080	Total class VII	63, 169
Unit IVw–2	1, 999	Unit VIIIs–8	26, 500
Unit IVs–7	3, 740	Total class VIII	26, 500
Total class IV	35, 167	Total for the Area	298, 992
Unit Vs–7	4, 142		
Total class V	4, 142		

In summary, the land in classes I through IV, is 52,830 acres; classes V through VII, is 219,662 acres; and the rest, 26,500 acres in class VIII, is used mainly as watershed and to provide food and cover for wildlife.

Management by Capability Units

The productivity and responses of a soil depend on many factors, especially on the nature of the soil, the climate in which it is located, and the management it receives. Soil characteristics and climate cannot be changed readily. Management, on the other hand, is subject to control. Changes in the management of some soils can drastically change the quality and yield the crop produces. Depending on the kind, recurring practices in management establish a trend toward improvement, maintenance, or depletion of the soil in a field.

A good system of soil management is likely to consist of a combination of several practices. Among these practices are the use of a good cropping system, application of fertilizer, and cultivating on the contour or across the slope. The effectiveness of any one practice is dependent upon other practices. For example, a diversion system for disposal of storm water may cause gullying unless the water is directed into an adequate grassed waterway or other suitable channel.

Because of the wide variety of soil and climatic factors, it is desirable to group many of these combinations of practices for ease of handling and treating the soils. Such a grouping has been made in this section. This section contains a description of the resource area and of the basic assumptions considered in establishing the capability classification in the resource area; and a description of each capability unit, a list of the soils in it, and some suggestions for the use and management of the soils. Further information about each kind of soil is given in the section "Descriptions of the Soils." Specific management of the soils in each unit for range or for woodland is discussed in the subsections, "Pasture and Range Sites" and "Woodland Suitability Groups."

Land resource area 18.—This land resource area is in the foothills of the Sierra Nevada Range. It is rolling to hilly and is dissected by rivers and streams that flow southwestward. Slopes are steep at the upper elevations, but they gradually level off as they merge with the plains of the Great Central Valley. The elevations range from 250 to 1,500 feet, and the average annual rainfall is 20 to 40 inches. All of the soil associations in the two physiographic regions of the middle and lower foothills and of the Arroyo Seco pediment, alluvial stream terraces, and flood plains are in land resource area 18.

The major factors that limit the use of these soils are steep slopes, nearness of bedrock to the surface, stones and rocks in the profile, low water-holding capacity, low fertility, poor drainage, poor soil structure, and damage caused by flooding.

Basic facts and assumptions considered in establishing the capability classification for land resource area 18 are as follows:

1. Irrigation water is available, or will be available when plans for future water development are realized, for all soils more than 36 inches in depth. The soils may have other deficiencies, but they are not sufficient to restrict production of cultivated and irrigated crops. No attempt has been made to exclude tracts that it might not be possible to irrigate because of location. It is assumed that the soil will be used at its highest productive

potential with irrigation water and that rainfall in most years is adequate for dry-farmed crops commonly produced. The capability classification of soils that have severe or very severe limitations that preclude their use for cultivated crops is based on their productive capacity and the hazards if used for range or woodland.

2. Drainage improvement and flood protection is not now feasible on Honcut very fine sandy loam, channeled, or on Mixed wet alluvial land.
3. A moderately high level of management is assumed.
4. The major crops produced in the area are cereal grain, hay, alfalfa, irrigated pasture, deciduous fruit and nuts, vineyards, and a few row crops.
5. The frost-free period ranges from 200 to 270 days; it generally extends from March 1 to November 15. The average annual rainfall is 20 to 40 inches. Potential evapotranspiration for the frost-free season is about 25 to 31 inches. Actual evapotranspiration for the frost-free season is 10 to 12 inches for a soil holding 4 inches of available water. For further information about the climate see the subsection "Climate" in the section "General Nature of the Area."

Land resource area 22.—This land resource area is part of the Sierra Nevada Range. It is characterized by hilly uplands, steep and mountainous ridges, and narrow valleys (fig. 6) that are more V-shaped with increasing elevation.

***Figure 6.*—Typical view of land resource area 22. In the foreground are wine grapes on loamy alluvial soils, and in the background are olives and pasture on Josephine soils.**

Ridges on volcanic conglomerate are generally flat and tabular, but they have steep side slopes. Areas on slate are commonly angular and sharp. Wide mountain valleys in some places occur where a drainageway widens. This land resource area is bordered by rivers and laced by smaller streams and creeks. The elevations range from 1,200 to more than 5,000 feet. Precipitation, which ranges from 30 to more than 45 inches, increases with increasing elevation; a large part of it falls as snow. In this land resource area, the soils formed principally under forests of conifers and hardwoods. All of the soil associations in the physiographic region of the mountainous uplands are in land resource area 22.

The major factors limiting the use of these soils are low temperatures in winter, steep slopes, nearness of bedrock to the surface, stones and rocks in the soils, low water-holding capacity, low fertility, and poor drainage.

Basic facts and assumptions considered in establishing the capability classifications for soils in land resource area 22 are as follows:

1. Irrigation water is available, or will be available, for all soils that are suited to cultivation. No attempt has been made to exclude tracts that, because of their location, might not be irrigated. Much of this land resource area is in profitable stands of timber. As areas elsewhere in the State are urbanized, it is expected that the acreage of these soils used for crops will increase.
2. Drainage improvement and flood protection are not now considered economically feasible on Mixed alluvial land.
3. A moderately high level of management is assumed.
4. The major crops produced in this land resource area are timber, dryland pasture, hay, grain, deciduous fruits and nuts, grapes, and some irrigated pasture.
5. The frost-free period ranges from about 140 to 200 days. It generally extends from April 16 to October 1. The average rainfall is about 30 to 45 inches. Potential evapotranspiration for the frost-free season is about 17 to 24 inches. Actual evapotranspiration for the frost-free season is 6 to 24 inches for a soil holding 4 inches of available water. For further information about the climate see the subsection "Climate" in the section "General Nature of the Area."

Capability unit I–1(18)

In this unit are very deep, nearly level, well-drained soils on flood plains, stream terraces, and valley bottoms. These soils formed in recent alluvium and are 60 inches or more in depth. They consist of stratified deposits of alluvial materials. In the Jackson and Ione Valleys, the soils formed in alluvium from various kinds of rock that were dominantly basic. On river terraces adjacent to the Mokelumne River, the soils formed in material from alluvium that was dominantly granitic.

All of the soils in this unit are fertile, are easy to work, and have very high water-holding capacity. Permeability ranges from moderate to moderately slow.

The soils in this unit are shown in the list that follows. One of these, the Snelling, is behind the dam at Camanche and will be inundated by floodwater.

Ho Honcut very fine sandy loam.
Hn Honcut silt loam.
SvA Snelling fine sandy loam, 0 to 2 percent slopes.

These soils are suited to all crops that are suitable for the climate of the Area. Crops on the soils include alfalfa, dry beans (fig. 7), corn, and pasture where irrigation water is available. Where irrigation water is not available, barley, oats, wheat, milo, and other field crops are grown or the soils are used for range. A small acreage is planted to deciduous fruit and walnuts; these crops generally are grown without irrigation.

For maximum yields, most crops on these soils require fertilizer that contains nitrogen and phosphate, but alfalfa and other legumes respond to phosphate alone. Soils planted intensively to grain or to grain hay are likely to be depleted of organic matter in many places, and good management is needed to restore high yields and to maintain them.

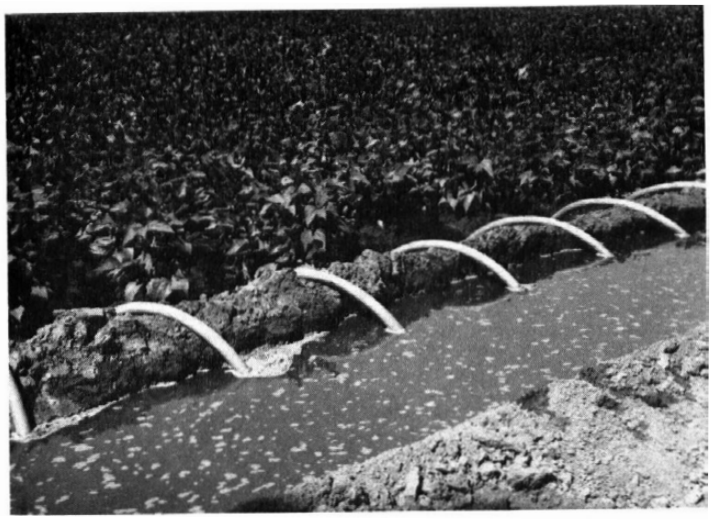

Figure 7.—**Dry beans on irrigated field of Honcut very fine sandy loam.**

The use of green-manure crops, crop rotations, and crop residues helps maintain organic matter and plant nutrients. The green-manure crop should be grown in rotation with legumes and grasses for pasture 1 year out of every 3 to 5 years. Return all crop residues to the soil and apply barnyard manure and refuse from stables or other sources.

On these soils, yields of irrigated pasture are good. Dividing each pasture into several units and grazing each unit in rotation allow the plants to recover. Grazing the pastures when wet should be avoided, as the animals compact the soils.

Furrows, borders, or sprinklers can be used for irrigating, depending on the soil and the crop. The length of runs for furrows and borders and the rate of application by sprinklers varies with the soil texture, the head of water, and the slope. Enough water needs to be applied to wet the soil evenly to the rooting depth of the crop grown. Avoid wasting water through overirrigation. A soil auger or shovel can be used to check the depth that water penetrates. These soils are deep or very deep, but they are stratified in places with sand or gravel or are underlain by other sediments that vary in texture and that would be detrimental if unearthed or exposed by land leveling.

Capability unit IIe–1(22)

The soils in this unit are deep to very deep, well drained, and gently sloping. They are on ridges, or on concave slopes, or along stream terraces at high elevations. In most of the soils, the texture of the surface soil is loam (fig. 8), but in some it is gravelly. The amount of gravel in the soils, however, does not appreciably affect the water-holding capacity or internal drainage. The texture of the subsoil ranges from loam to clay. In most of the soils, permeability of the surface soil is moderate and that of the subsoil is moderate to moderately slow.

These soils have moderate to high fertility. Except for the Fiddletown soil, which has moderate water-holding capacity, the soils have high to very high water-holding capacity. The soils are friable and fairly easy to work, but in a few places rocks in the profile interfere with cultivation.

The soils in this unit are—

AhB Aiken loam, 3 to 9 percent slopes.
FgB Fiddletown gravelly loam, deep, 3 to 10 percent slopes.
Lo Loamy alluvial land.
SnB Sites loam, 3 to 9 percent slopes.

The soils in this unit are suited to crops that tolerate the low temperatures that generally occur in the mountainous uplands late in fall, in winter, and early in spring. The crops grown include irrigated pasture plants, some orchard crops, grapes, cereal grain, grain hay, and some vegetables. Water for irrigation is limited in most places, but in years when rainfall is normal some crops can be grown without irrigation. If controlled, erosion is a minor problem. Crops on these soils respond to nitrogen fertilizer; some crops also respond to phosphate.

Sheet erosion can be controlled by tilling across the slope, growing cover crops in orchards and vineyards, leaving stubble mulch on grainfields, and using other practices that are easy to apply. In places diversions are needed along with a system to remove runoff water to prevent the water from concentrating and causing gullies. On areas adjacent to streams, levees are required in places, or alinement of the channel is needed to help prevent flooding. Water for irrigation can be applied by borders or furrows on gentle slopes, but on slopes steeper than 5 percent, sprinkler irrigation should be used.

The soils in this unit are some of the best soils in the Area for timber, and it is profitable to keep them in this use. If the soils are cropped, trees and stumps must be

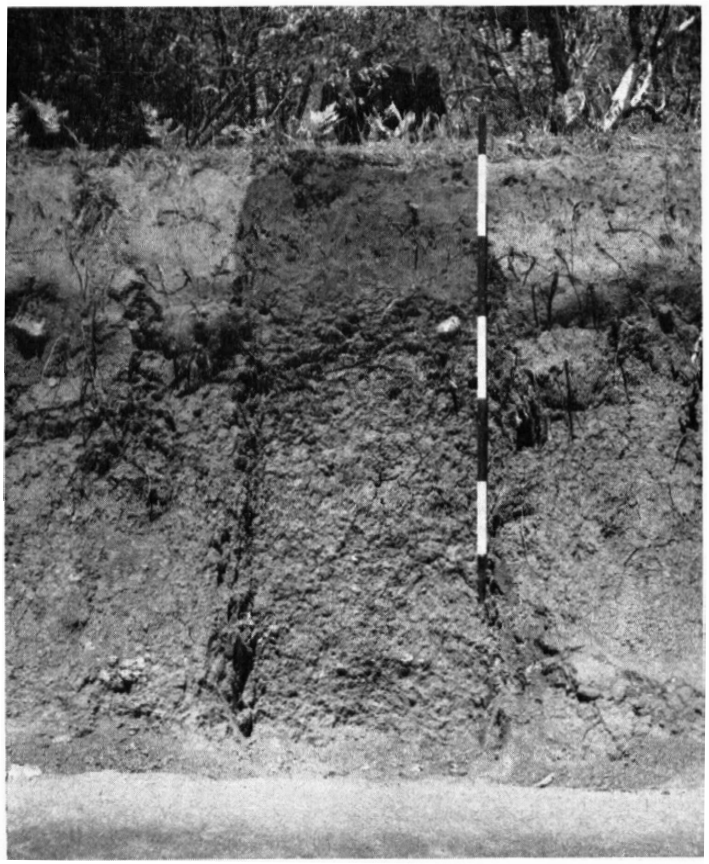

Figure 8.—**Profile of Aiken loam, 3 to 9 percent slopes, a deep, forest soil in capability unit IIe–1(22).**

removed from some areas. Generally, cleared areas are used for grazing because of the lack of irrigation water.

Capability unit IIw-2(18)

The soils in this unit are moderately well drained or imperfectly drained and are mostly nearly level. They are in depressions in valley bottoms, or are in swales and in drainageways. The Honcut soil is in Jackson and Ione Valleys, generally back from the creeks or behind natural levees built up by the creeks. The Snelling soil, in swales and drainageways in the Shenandoah Valley, formed in material from granitic alluvium. The surface layer of the soils in this unit ranges from loam to very fine sandy loam. The subsoil is clay loam or sandy clay loam.

The soils in this unit are generally fertile. Permeability ranges from moderate to moderately slow. The finer textured subsoil or impermeable substratum impedes drainage. As a result, runoff collects in low-lying areas during rainy periods. Where the slope is as much as 9 percent, the soils are affected by seepage in places. Free water is present in the profile in places and delays tillage and planting or damages deep-rooted crops. Also, if the soils are cultivated or are grazed intensively when too wet, they compact or puddle and drainage is further restricted. Rock outcrops hinder tillage of the Snelling soil in places.

The soils in this unit are—

Hs Honcut very fine sandy loam, moderately well drained.
SuB Snelling loam, moderately well drained, 0 to 9 percent slopes.

These soils are well suited to shallow-rooted crops, and if drainage is provided, to a wider range of crops. They are productive if well managed. Because of the low position and impeded drainage of these soils, practices are needed that provide drainage and prevent flooding. Excess runoff should be diverted into suitable outlets, and mole drains, open drains, or tile drains can be used for drainage. In some places it is necessary to straighten creek channels and construct levees to prevent flooding.

If application of irrigation water is not controlled, these soils are likely to become ponded or waterlogged.

Organic matter can be supplied and good tilth maintained if plant residues are turned under and manure is added.

For pasture plants and similar crops, a perched water table provides favorable plant-moisture relationships through subirrigation. For alfalfa and other deep-rooted crops or for orchard crops, however, drainage is necessary.

Capability unit IIIe-1(18)

This unit consists of deep, well-drained, undulating to gently rolling soils. They are mainly in the Shenandoah Valley, but a large part of the Snelling soils is near the Mokelumne River. The soils in this unit formed in material from granitic rock or granitic alluvium. The surface soil is moderately coarse textured; the texture of the subsoil ranges from sandy loam to clay loam. The vegetation is mostly grass-oak, but there are a few scattered conifers.

The fertility of these soils ranges from moderate to high. Permeability ranges from moderately rapid to moderately slow. The water-holding capacity is high. Except for a few rock outcrops in the Sierra soils that hinder tillage in places, the soils are fairly easy to work. The erosion hazard is moderate to severe if these soils are left finely tilled or without vegetative cover during the rainy period. In some places, because of past cropping practices, the Sierra soils are moderately eroded and have lost as much as 50 percent of their original surface soil.

The soils in this unit are shown in the list that follows. A large part of two of these soils, the Snelling, is behind the Camanche Dam and will be inundated by water.

SgB Sierrra coarse sandy loam, 3 to 9 percent slopes.
SgB2 Sierra coarse sandy loam, 3 to 9 percent slopes, eroded.
SvB Snelling fine sandy loam, 2 to 5 percent slopes.
SvC Snelling fine sandy loam, 5 to 9 percent slopes.

These soils are better suited to pasture plants, or to other crops that provide ground cover, than to tilled crops. If these soils are cropped, they are mostly dry-farmed to barley, oats, wheat, grapes, walnuts, peaches, prunes, or pasture. These crops respond if fertilizer that contains nitrogen and phosphate is added and if sulfur is added occasionally.

The use of suitable cropping systems, green-manure crops, plant residues, and mulch improves intake of water, provides needed organic matter, and helps control erosion (fig. 9). A suitable rotation is 1 year of hay and grain crops and 3 or 4 years of pasture. All tillage and planting ought to be on the contour or across the slope. Green-manure crops and plant residues should be plowed under and straw from harvesting grain left on the surface as mulch.

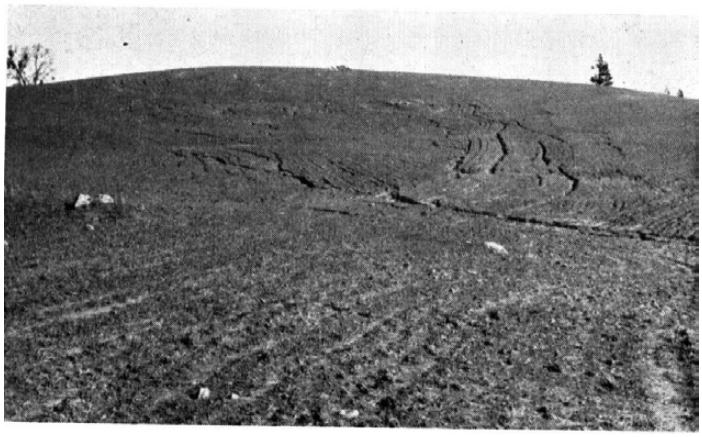

Figure 9.—**Rill and gully erosion on a Sierra coarse sandy loam, which could be reduced if tillage were done across the slope and a cover of vegetation left on the soil during the rainy period.**

Dry-farmed orchards and vineyards can be interplanted with cover crops or wild grasses and weeds can be left in winter during the rainy period to protect the soil. In spring after the rainy season, the cover can be plowed under to conserve soil moisture. Subsequent weed control is best done by chemical spraying.

A sprinkler system is best to use for irrigated crops. By this method, the water can be applied evenly and at a rate that permits the soil to absorb it. Waterways and protected outlets should also be provided.

A large acreage is used for range. If the range is well managed, yields of forage are good. The eroded soil is less productive, however, than the other soils and generally requires intensive management for increased yields.

Capability unit IIIe–1(22)

This unit consists of deep and very deep, well-drained, moderately sloping to strongly sloping soils. These soils are at high elevations. The moderately coarse textured soils from grantitic sources erode readily. The soils formed in material from volcanic conglomerate, slate, and schist and are fairly stable and loamy. The slope is generally smooth, but in a few places it is cut by minor drainageways.

These soils are moderate to moderately high in fertility. Their water-holding capacity is high to very high. Permeability of the surface soil ranges from moderately rapid to moderate, and that of the subsoil from moderate to moderately slow. Except for a few rock fragments that hinder cultivation in places, the soils are fairly easy to work.

The soils in this unit are—

AhC Aiken loam, 9 to 16 percent slopes.
CaC Cohasset loam, 5 to 16 percent slopes.
HdC Holland coarse sandy loam, deep, 5 to 9 percent slope.
JnC Josephine loam, deep, 9 to 16 percent slopes.
MuB Musick sandy loam, 3 to 9 percent slopes.
SnC Sites loam, 9 to 16 percent slopes.

The soils in this unit are used mostly for the production of timber. They are among the most productive soils for timber in the Area. The climate, erosion hazard, shortage of water for irrigation, and expense of clearing brush, trees, and stumps limit the use of the soils for crops. Some areas are cleared, however, and used for pastures, apple and walnut orchards, vineyards, and crops such as hay and grain. The areas are small and management is not intensive, and as a result, yields are only poor to fair. Large acreages of pears and apples are grown on similar soils under irrigation in El Dorado County, which adjoins the Area. Management suggested for capability unit IIe–1(22) can also be applied to this unit.

Capability unit IIIe–3(18)

Only one soil is in this unit. It is deep, is gently sloping to sloping, and has a slowly permeable subsoil. The areas are on terraces above more recent deposits in valley bottoms. The surface soil is loam, but it is gravelly in places. The subsoil is clay loam or clay and overlies consolidated alluvium.

The surface layer of this soil is penetrated by roots and water, but the subsoil restricts penetration. This soil is moderate to low in fertility. Too much rainfall or irrigation water causes temporary waterlogging and rapid runoff. The structure of the surface soil is weak; consequently, it is easily puddled or compacted if grazed or worked when wet.

The soil in this unit is—

PrC Perkins loam, 3 to 16 percent slopes.

This soil is well suited to grain, hay crops, and pasture and to row crops that are shallow rooted.

Practices similar to those for capability unit IIIe–1(18) are needed on this soil. The use of crop rotations, green-manure crops, and crop residues helps control erosion, maintains soil structure, and improves fertility. Cultivated crops should be grown in rotation with pasture crops, and all tillage should be across the slope. Green-manure crops and crop residues should be returned to the soil. Crops on this soil respond if fertilizer that contains nitrogen and phosphate is applied.

Irrigation must be controlled carefully to avoid saturating the soil, and a sprinkler system is better to use than other methods for applying irrigation water. On long slopes, diversion ditches are needed to intercept runoff water and convey it to suitable outlets.

Capability unit IIIe–8(18)

In this unit the soils are moderately deep to bedrock and are mostly gently sloping to sloping. The dominant slope is 3 to 16 percent. In a small acreage, however, the soils are nearly level. The surface soil is chiefly loam or silt loam. The subsoil is mostly loam, silt loam, or clay loam.

The soils in this unit have moderate available water holding capacity, and they are mostly moderate in fertility. Roots penetrate to a moderate depth. Permeability of the soil is generally moderate or moderately slow. The Argonaut silt loam, however, has a very slowly permeable clay subsoil. In all of the soils, rock fragments interfere with tillage in places. A small acreage, where the soils are from granitic sources, is moderately eroded.

The soils in this unit are—

AaB Ahwahnee loam, 3 to 9 percent slopes.
AaB2 Ahwahnee loam, 3 to 9 percent slopes, eroded.
ArC Auburn silt loam, moderately deep, 3 to 16 percent slopes.
AwC Auburn silt loam, 0 to 16 percent slopes; Argonaut silt loam, 0 to 16 percent slopes; in mapping unit AwC, Auburn-Argonaut silt loams, 0 to 16 percent slopes.
IdC Inks loam, deep variant, 3 to 16 percent slopes.
ShB Sierra coarse sandy loam, moderately deep, 3 to 9 percent slopes.
ShB2 Sierra coarse sandy loam, moderately deep, 3 to 9 percent slopes, eroded.

These soils are used chiefly for grazing cattle. Production of usable forage is high. Dry-farmed hay and grain are the main crops, but a small acreage is planted to grapes and deciduous orchards. Generally, water is not available for irrigating crops, but if it is available, the soils are suited to pasture, corn, milo, vineyards, and small fruits.

The use of green-manure crops, crop rotations, and crop residues helps control erosion, adds organic matter, maintains soil structure, and improves fertility. The green-manure crops can be grown in rotation with grain. All tillage should be on the contour or across the slope. Plant residues and animal manure should be turned under. In grainfields, straw and other residues from the plants should be left on the surface as a mulch. Pasture in poor condition ought to be deferred from grazing or reseeded to more productive grasses and legumes. Most nonleguminous crops on these soils respond if fertilizer that contains nitrogen is added and if a phosphate fertilizer is applied frequently. Clover and trefoil respond to phosphate fertilizer.

Water for irrigation can be applied more evenly by sprinklers than by other irrigation systems, and by this method, saturating the soil is also avoided.

Capability unit IIIe–8(22)

The soils in this unit are moderately deep to deep and mostly gently sloping to sloping. These soils formed mainly in material from folded and tilted metasedimentary rock composed of different kinds of minerals. A small acreage, however, consists of gently sloping soils formed in material from granitic rock. Although the

soils vary in depth, they are predominantly moderately deep. The vegetation consists mainly of conifers, hardwoods, brush, and grass, but in places bracken fern or mountain misery forms a dense understory in stands of timber.

The texture of the surface soil ranges from loam to sandy loam. The available water holding capacity is mostly moderate. Root penetration is moderately deep to deep. Permeability is moderately rapid to moderate in the surface soil and moderately rapid to moderately slow in the subsoil. In places rock fragments interfere with tillage.

The soils in this unit are—

FdC Fiddletown gravelly loam, 9 to 16 percent slopes.
HcC Holland coarse sandy loam, 5 to 9 percent slopes.
JmC Josephine loam, 3 to 16 percent slopes.
SoC Sites loam, moderately deep, 3 to 16 percent slopes.

Most areas of these soils are used for timber. Cleared areas are generally used for grazing, but a few are planted to grapes and to orchards for family use.

If these soils are managed carefully, they are fairly well suited to hay and grain crops, grapes, pears, and apples. Where irrigation water is available, the soils are well suited to pasture and to other close-growing crops.

Close-growing crops should be kept on these soils two-thirds of the time. If the soils are used for crops, all cultivation should be done across the slope. Orchards and vineyards ought to be interplanted with cover crops. The use of plant residues and green-manure crops helps maintain the content of organic matter and increases fertility. Most crops on these soils respond if fertilizer that contains nitrogen and phosphate is applied.

Capability unit IIIw–3(18)

In this unit are imperfectly drained or moderately well drained, mostly nearly level soils that contain a slowly permeable layer or are moderately deep over bedrock. These soils are in depressions in valley bottoms, in swales, or in drainageways where excess runoff and seepage water accumulates. The texture of the surface soil ranges from moderately coarse to moderately fine. Depth to the very slowly permeable clay subsoil or the bedrock substratum is about 18 to 36 inches. The largest acreage is nearly level, but in places in swales the slope is as much as 9 percent.

The soils in this unit have slow internal drainage. In places excess water in the profile during the rainy season delays tillage and planting of crops or damages the crops that are growing. If the soils are cultivated when too wet, they compact, and then drainage is even more restricted.

The soils in this unit are—

Hm Honcut clay loam, over clay.
LgB Laniger sandy loam, thick surface, 0 to 5 percent slopes.
SfB Shenandoah loam, 3 to 9 percent slopes.

Most of the soils in this unit are suited to pasture, hay, and grain. The Honcut soil is suited to pasture or to shallow-rooted crops, and if drainage is provided, to row crops, field crops, and orchard crops.

The use of plant residues, green-manure crops, and animal manure supplies organic matter and maintains good tilth. On selected sites, use of open ditches provides drainage and helps control excess runoff and seepage. The Honcut soils have a slowly permeable, clayey subsoil. The Laniger and Shenandoah soils are underlain by bedrock, generally at a depth below 36 inches, and installing tiles for drainage in these soils is not feasible.

Water for irrigation must be applied carefully to avoid ponding and waterlogging. Sprinkler systems are better to use than furrows or borders to control the quantity of water applied and to keep from saturating the soil.

If excess water can be controlled and a good plant-soil-moisture relationship maintained, unimproved areas used for range are well suited to selected perennial grasses and legumes in places. Pastures on these areas relieve grazing pressure on adjoining annual range and extend the grazing period. If livestock are allowed to graze on pasture that is too wet, they cause the soils to puddle and compact.

Capability unit IIIs–3(18)

In this unit are deep, nearly level soils that are moderate to low in fertility and lack favorable soil structure. These soils are on terraces slightly above the Jackson and Ione Valleys and on flats in the Carbondale area. The surface soil is generally loam, but in places it is gravelly. Its structure is poor, especially in overgrazed fields. The subsoil is fine textured, compact, and hard. It takes in water slowly and restricts growth of plant roots. The soils in this unit tend to seal and crust when they dry out after a wetting. Because of slow runoff, the surface soil stays wet in many places.

The soils in this unit are—

PrA Perkins loam, 0 to 3 percent slopes.
RyA Ryer silty clay loam, 0 to 3 percent slopes.

These soils are well suited to irrigated pasture, hay, grain, and other shallow-rooted crops. They are also suited to such row crops as milo or corn. Large amounts of fertilizer that contains nitrogen and phosphate are needed for high yields. Subsoiling is needed in places to shatter tillage pans, but it should not be done if the soils are wet. Cover crops, green-manure crops, and crop residues are needed to increase organic matter. Practices for improving soil structure and tilth, described under capability unit IIIe–1(18), also apply to these soils.

Irrigation water should be applied carefully so as to prevent waterlogging above the dense subsoil. Sprinklers are desirable for irrigation because they apply water evenly and at a controlled rate. Borders and furrows can also be used for irrigation if care is used to prevent ponding.

Because of the shortage of irrigation water, a large acreage of these soils is used as annual range. Yields of forage are moderately high if the soils are well managed, and they increase if fertilizer that contains nitrogen and phosphate is applied. Overgrazed range or range in poor condition can be improved if suitable grasses and legumes are planted. The withholding of grazing by livestock when the soils are wet prevents trampling and compaction of the soils.

Capability unit IVe–1(18)

The soils in this unit are deep, rolling, well drained, and subject to erosion. These soils formed in material from granitic rock and granitic alluvium. They are underlain by bedrock or stratified sediments at a depth of 30 to more than 60 inches. The areas are mainly in the Shenandoah Valley and along the Mokelumne River and the western boundary of the Area. The vegetation is mainly grasses, forbs, scattered oaks, and a few pon-

derosa and digger pines. Some areas are moderately eroded because of past cropping practices.

The soils in this unit are—

SgC Sierra coarse sandy loam, 9 to 16 percent slopes.
SgC2 Sierra coarse sandy loam, 9 to 16 percent slopes, eroded.
SwD Snelling sandy loam, 9 to 16 percent slopes.

Large areas of these soils are used for grazing. The soils are best kept under a cover of grass or close-growing crops. If the soils are managed carefully, grain and hay can be grown in rotation with pasture 1 year out of 5. Vineyards and orchards are suited if interplanted with cover crops or if mulches, annual grasses, or other protective cover is used.

Because of the slope, stabilizing practices that control erosion are needed, especially if the soils are tilled or are otherwise disturbed. All tillage should be done at right angles to the direction of the slope, and new orchards or vineyards should be planted on the contour. On long slopes, stripcropping and diversion terraces are needed. Furrows plowed on the contour when the soils are dry increase absorption of water and reduce runoff. All crop residues should be returned to the soil; straw and other residue from harvesting grain help reduce erosion if left on the surface as a mulch. Water for irrigation, if available, should be applied by sprinklers.

Capability unit IVe–1(22)

In this unit are deep, rolling to hilly, well-drained soils subject to erosion. These soils have high water-holding capacity and are moderately fertile. Permeability is moderately rapid to moderately slow.

The soils in this unit are—

CaD Cohasset loam, 16 to 31 percent slopes.
HdD Holland coarse sandy loam, deep, 9 to 16 percent slopes.
JnD Josephine loam, deep, 16 to 31 percent slopes.
MuC Musick sandy loam, 9 to 16 percent slopes.
SnD Sites loam, 16 to 31 percent slopes.

These soils are better suited to timber than to tilled crops. Strong slopes and susceptibility to erosion are the major problems if this soil is cropped intensively. In addition, lack of irrigation water and low temperatures in winter limit use of these soils. Generally, cleared areas are used for grazing, but a small acreage is planted to hay and grain, to vineyards, and to orchards of apples and pears.

If these soils are cropped, management practices suggested for soils in capability unit IIe–1(22) can be applied. The soils produce rapid-growing stands of timber of good quality if they are well managed.

Capability unit IVe–3(18)

In this unit are shallow to moderately deep, gently sloping to moderately steep soils that are clayey or have a very slowly permeable clay subsoil. The areas in swales remain wet after a heavy rain. Wiregrass and sedges that tolerate wetness are common in most places.

These soils are moderately well drained to somewhat poorly drained. Their water-holding capacity is moderate. Permeability is slow. Fertility is moderate in the Argonaut soil and low in the Peters. In the Argonaut soil a lens of broken stone occurs just above the clay subsoil at a depth of 10 to 14 inches. Generally, in this soil, roots and water can penetrate the lens but the clay subsoil restricts further penetration; however, in a few places roots follow cracks and cleavages in the rock to a moderate depth.

The soils in this unit are—

AnD Argonaut gravelly loam, 3 to 31 percent slopes.
PtB Peters clay, 3 to 9 percent slopes.

The soils in this unit are best suited to grazing. These soils can be cultivated for production of hay and grain or for irrigated pasture, but in some places rock outcrops interfere with cultivation.

If these soils are used for cultivated crops, a cover of grasses and legumes should be kept on them 4 out of 5 years. Crops on these soils respond well if fertilizer that contains nitrogen and phosphate is applied. The use of crop residues, cultivation across the slope, and stripcropping on long slopes reduces runoff and helps control erosion. Other management requirements are similar to those for the soils of capability unit IIIe–8(18).

If these soils are irrigated, sprinklers are best to use because they apply the water more uniformly than other irrigation systems. These soils compact easily and should not be grazed or cultivated when wet.

Capability unit IVe–39(18)

This unit consists of nearly level to rolling soils that have low to very low fertility and a slowly permeable subsoil. These soils formed in sandy and clayey marine sediments or in old gravelly outwash from the Sierra Mountains. They are on dissected terraces in the western part of the Area. The relief is commonly moundy or hummocky.

The surface soil is generally gravelly sandy loam or loam and is underlain at a moderate depth by clay, sandy clay, or silty clay that restricts penetration, or is underlain by impermeable substratum. It is slightly acid to medium acid. The subsoil is mostly strongly acid to extremely acid and is generally fine textured. Internal drainage is impeded in these soils (fig. 10). As a result, during the rainy season free water occurs in the upper part of the profile and stands on the surface. The structure of the soils is mostly massive. Weak soil aggregation, the hummocky relief, and in places, gravel make these soils difficult to work.

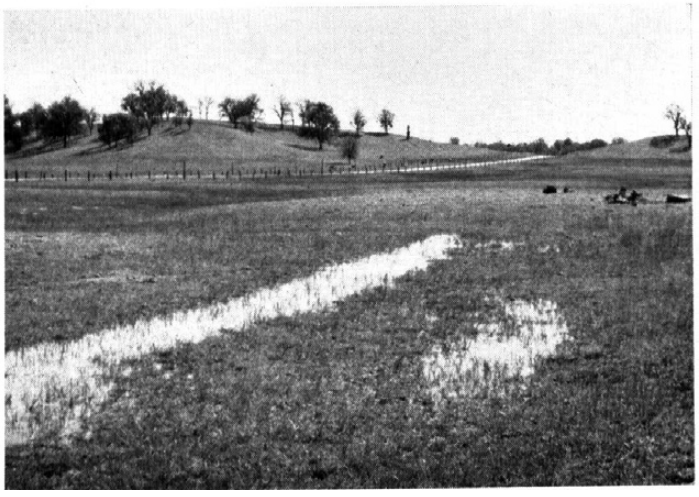

Figure 10.—**Wet spots in Mokelumne soils and Alluvial land indicate impeded drainage.**

The soils in this unit are—

Ma Made land.
MrB Mokelumne sandy loam, 2 to 5 percent slopes.
Mt Mokelumne sandy loam, 2 to 5 percent slopes; in mapping unit Mt, Mokelumne soils and Alluvial land.
RbB Red Bluff gravelly loam, 0 to 5 percent slopes; Mokelumne gravelly sandy loam, 0 to 5 percent slopes; in mapping unit RbB, Red Bluff-Mokelumne complex, 0 to 5 percent slopes.
RbD Red Bluff gravelly loam, 5 to 16 percent slopes; Mokelumne gravelly loam 5 to 16 percent slopes; in mapping unit RbD, Red Bluff-Mokelumne complex, 5 to 16 percent slopes.
RmD Red Bluff gravelly loam, 2 to 16 percent slopes; Mokelumne gravelly sandy loam, 2 to 16 percent slopes; in mapping unit RmD, Red Bluff-Mokelumne-Mine Pits complex, 2 to 16 percent slopes.

These soils are used mostly for grazing. If large amounts of fertilizer are applied, the soils are also suitable for pasture (fig. 11), hay, and grain and to some specialty crops or row crops. The increased yields, however, may not warrant the cost of fertilizing.

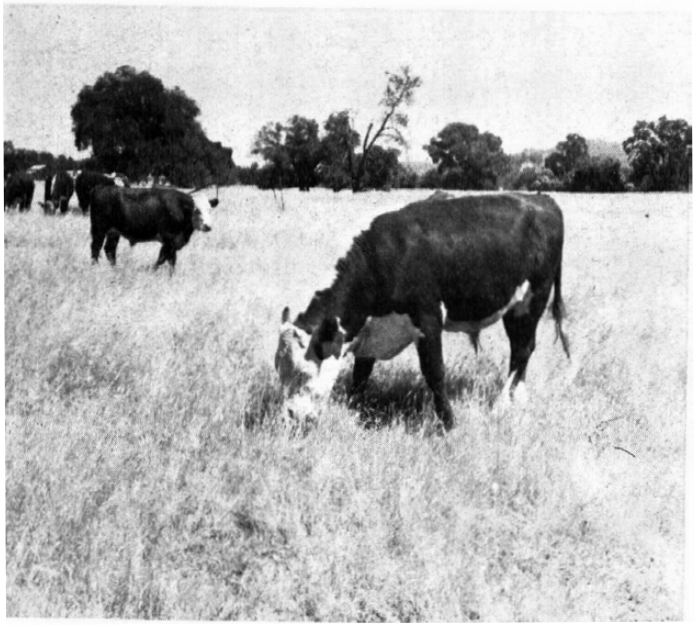

Figure 11.—**Pasture on Mokelumne soils and Alluvial land that has been fertilized.**

Generally, these soils are low in nitrogen, phosphorus, and in some places, in sulfur. Lime would probably reduce acidity of the subsoil if incorporated in the soil by tillage, but tests have not been made to determine the amount needed.

The use of green-manure crops and plant residues improves tilth and increases the content of organic matter. Farming across the slope and stripcropping on long slopes reduce runoff and help control erosion. A cover of permanent vegetation in waterways helps prevent gullies from forming. These soils are easily compacted and should not be grazed or cultivated when wet. On some rangeland, yields of forage increase if brush is controlled and trees removed.

A small acreage of these soils is used for irrigated pasture. Irrigation water should be applied uniformly, and sprinklers are best to use.

Capability unit IVe–4(18)

This unit consists of shallow, nearly level to rolling soils that have moderate to low water-holding capacity. These soils formed in material from metabasic and metasedimentary rock. They are mostly moderate in permeability. Rock fragments are generally turned up when the soil is tilled; therefore, tillage should be fairly shallow to avoid buried bedrock.

The soils in this unit are—

ApD Auburn silt loam, 0 to 31 percent slopes.
EhD Auburn loam, 3 to 31 percent slopes; in mapping unit EhD, Exchequer and Auburn loams, 3 to 31 percent slopes.

These soils are best suited to grazing. If they are managed carefully, however, they can be cropped in rotation with hay and grain 1 year out of 5 years. A small acreage is planted to dry-farmed vineyards.

If this soil is cropped, tillage should be across the slope. Disking in plant residues and animal manure increases fertility and the content of organic matter. Forage plants on these soils respond if fertilizer that contains nitrogen and phosphate is applied.

In most places the soils are well suited to irrigated pasture. If water is available for irrigating, sprinklers are best to use.

Capability unit IVe–8(18)

This unit consists predominantly of strongly sloping, moderately deep, eroded soils. Most of these soils formed in material from granitic or related rock, but the Auburn and Laniger soils formed in material from metabasic and metasedimentary rock.

The permeability of the soils in this unit is moderate to moderately slow. The available water holding capacity and fertility are mostly moderate. Root penetration is moderately deep. In places submerged rock fragments interfere with tillage. In some places the granitic soils are moderately eroded.

The soils in this unit are—

AaC Ahwahnee loam, 9 to 16 percent slopes.
AaC2 Ahwahnee loam, 9 to 16 percent slopes, eroded.
ArD Auburn silt loam, moderately deep, 16 to 31 percent slopes.
LaC Laniger sandy loam, 2 to 16 percent slopes.
ShC Sierra coarse sandy loam, moderately deep, 9 to 16 percent slopes.
ShC2 Sierra coarse sandy loam, moderately deep, 9 to 16 percent slopes, eroded.

These soils are best suited to grazing, and they provide some of the most productive range in the Area. Hay or grain crops, irrigated pasture, and grapes can be grown if the soils are carefully managed.

If these soils are cultivated, a suitable rotation is 1 year of hay or grain crops and 4 years of irrigated pasture for a good plant cover. In vineyards, cover crops can be planted between the rows. Chemical spraying provides best control of weeds. Farming across the slope and stubble mulching grainfields help control erosion. Other management for the control of erosion is similar to that for the soils in capability unit IIIe–8(18).

Capability unit IVe–8(22)

The soils in this unit are predominantly moderately steep, moderately deep, and well drained. They formed under forests of conifers and hardwoods in the mountainous uplands. In some places the vegetation has

been removed or has been destroyed by fire and the areas invaded by brush.

The texture of the surface soil is mostly loam. In a small acreage, however, the soil is granitic and the texture of the surface soil is coarse sandy loam. Here the soil is eroded and strongly sloping or gently sloping. In other places the soil is clayey and severely eroded and the slope is gentle to steep. The permeability of all of these soils is moderately rapid to moderately slow.

The soils in this unit are—

FdD Fiddletown gravelly loam, 16 to 31 percent slopes.
HcD Holland coarse sandy loam, 9 to 16 percent slopes.
JmD Josephine loam, 16 to 31 percent slopes.
SoD Sites loam, moderately deep, 16 to 31 percent slopes.
SpD3 Sites clay loam, moderately deep, 3 to 31 percent slopes, severely eroded.

These soils are used mostly for timber, and they are well suited to that use if they are well managed. The soils can be cultivated for production of hay, grain, grapes, and some fruits.

If these soils are used for hay and grain crops, they should be kept in grasses and legumes 4 out of 5 years. Cereal crops and pasture plants on these soils respond well to fertilizer that contains nitrogen and phosphate. Orchards and vineyards should be interplanted with cover crops to help hold the soil during the rainy season. Chemical spraying provides best control of weeds. The use of crop residues improves fertility and tilth of the soils. Tillage across the slope, use of stubble mulching in grainfields, and protecting waterways with a permanent cover of vegetation help control erosion. The severely eroded areas can be revegetated in places if grasses and legumes are reseeded, gullies are filled, and grazing is deferred or limited.

A small acreage of these soils is irrigated. Sprinkler irrigation is most suitable for uniform application of water.

Capability unit IVe–84(22)

Only one soil is in this unit. It is gently sloping to moderately steep, is shallow, and has low available water holding capacity. This soil is on ridge crests and side slopes. It formed in material from metasedimentary slate and schist. The vegetation consists of forests of conifers and hardwoods, of dense brush, and of open areas of grass.

The surface soil is gravelly, and the subsoil ranges from silty clay loam to clay loam. Depth to bedrock ranges from 12 to 26 inches. Root penetration is generally shallow, but in some places the roots of trees penetrate more deeply through fractures in the bedrock.

The soil in this unit is—

MbD Mariposa gravelly loam, 3 to 31 percent slopes.

This soil is best suited to timber. Cleared areas are used for grazing, but controlling regrowth of brush on the areas is a problem. On the gentler slopes, some areas are used for grain and hay, or if water is available, for irrigated pasture. A suitable rotation is 4 or 5 years of irrigated pasture and 1 year of hay.

Production of timber is low on this soil, but the trees provide protective cover, furnish suitable habitat for wildlife, and enhance the scenic value of the landscape.

Capability unit IVw–2(18)

In this unit are alluvial soils and land types that are subject to flooding or have imperfect to poor drainage. These soils are along stream channels or in valley bottoms. They are wet for long periods. The Honcut soil and large areas of Mixed alluvial land are commonly covered by sandy or gravelly deposits from floodwater. The texture of the soil material varies. In many places the areas are cut by channels made by water from the main stream during floods. In small, low areas the soil is meadowlike, dark colored, somewhat poorly drained to poorly drained, and wet most of the year.

Most areas in this unit are small and isolated, which hinders intensive management and use of large equipment. Many areas also have been disturbed by dredging, sluicing, or placer mining. Such areas are interlaced with gullies and have piles of material from dredging and large stones on them.

The soils in this unit are—

Hv Honcut very fine sandy loam, channeled.
Mo Mixed alluvial land.
Mp Mixed wet alluvial land.
Mt Alluvial land; in mapping unit Mt, Mokelumne soils and Alluvial land.

These soils are better suited to grazing than to other uses. Cultivating and planting are generally delayed because of rainy periods late in spring and because of flooding. Improved pasture, hay, and grain crops, or small vegetable gardens and family orchards, can be planted in protected areas. Areas that are channeled or excessively wet are best suited to pasture. Because of recent deposits of material by streams, fertility is moderate to high; nevertheless, crops on these soils respond to fertilizer that contains nitrogen and phosphate.

Management practices needed vary from site to site and can best be determined after investigating the individual site. Some areas could be improved by deepening, widening, and realining the drainage channels. The spoil material from the channels could be used to form protective levees. Excess water in wet areas could be partly removed if suitable outlets were provided.

Irrigation water is generally available from nearby streams. If irrigation water is pumped from a stream, sprinklers are most suitable for applying the water because of the sandy and gravelly layers in the soils. In small areas furrows and borders can be used in places to apply water diverted directly from a stream.

Capability unit IVw–2(22)

In this unit are areas of Mixed alluvial lands that are subject to flooding or have imperfect to poor drainage. The areas are along stream channels and in meadows at high elevations. The vegetation consists of sedges and grasses that tolerate wetness, of other grasses, and of forbs. Conifers and hardwoods border most areas.

Along the stream channels are mostly well drained, deep loams or sandy loams stratified with sand, gravel, and debris from mining. These areas are subject to frequent flooding from adjacent streams. The areas in meadow are affected by seepage or a high water table and are wet. Here the soil material is deep and is generally fine textured, dark, and somewhat poorly drained or poorly drained.

The soils in this unit are—

Mo Mixed alluvial land.
Mp Mixed wet alluvial land.

These soils occupy small, narrow areas along stream channels or isolated flats and are difficult to manage as a

unit. Most areas are used as summer range for cattle. Some areas are in gardens planted for home use, in orchards, or in pasture. Wet meadowlands are best suited to pasture because the growing season is somewhat limited and the acreage is small. Yields of usable forage can be improved on these wet areas if more productive grasses and legumes are seeded, if fertilizer that contains nitrogen and phosphate is applied, and if ditches are provided to improve spreading of water.

Capability unit IVs–7(18)

Only one soil is in this unit. It is very deep, gently sloping to steep, and well drained. This soil consists mostly of two large areas on ridges between the towns of Jackson and Sutter Creek. The slope is mainly less than 9 percent. The gently sloping areas were once cultivated and used for hay and grain, for vineyards, and for orchards. Cobblestones turned up when tillage was done were removed by hand and placed in fence rows or piles. The steeper areas were used for range. Now most areas have reverted to annual range and are used for grazing; only a small acreage remains in vineyards.

The texture of the surface soil is predominantly loam, but it borders on silt loam or clay loam. The subsoil ranges between clay loam and clay; its permeability is moderately slow. The natural fertility of this soil is moderately high. The available water holding capacity is high. Except where stones have been removed, the soil in most places contains large numbers of rounded cobblestones that are dominantly between 2 and 10 inches in diameter. The surface, however, is smooth and fairly free of cobblestones.

The soil in this unit is—

SxD Supan cobbly loam, 3 to 31 percent slopes.

This soil is best suited to pasture or to crops that require a minimum of tillage. In some places on gentle slopes, the soil can be worked if tillage is shallow and carefully done. The areas can then be seeded to pasture or to hay and grain, or can be planted to vineyards or orchards. When orchards or vineyards are established, weeds can be controlled by practices that do not require tillage, such as chemical spraying. Fertility can be maintained by applying commercial fertilizers and animal manure. It may be feasible to remove stones from gently sloping areas by hand or by mechanical rock pickers.

In most places irrigation water is scarce or expensive. If water is available for irrigation, it is best applied by sprinklers.

Capability unit IVs–7(22)

Only one soil is in this unit. It is deep, gently sloping to strongly sloping, and well drained. It is on tabular ridges and sidehills.

This soil has very high water-holding capacity and absorbs water well. Permeability is moderate in the surface soil and moderately slow in the subsoil. Fertility is moderately high. This soil is very friable in forested areas. In many places it contains large numbers of cobblestones and other stones that are dominantly between 5 and 16 inches in diameter and hinder cultivation.

The soil in this unit is—

AkC Aiken cobbly loam, 3 to 16 percent slopes.

This is one of the best soils in the Area for timber. It generally is too cobbly for intensive cultivation. In small acreages the stones have been removed by hand and the areas planted to apples, pears, and walnuts. Cleared areas are used mostly for pasture. If water is available, this soil is suited to irrigated pasture and other crops. This soil requires conservation practices similar to those for capability unit IIe–1(22) if it is used for crops.

If this soil is well managed, trees on it grow rapidly and are of good quality. Yields of timber are very high.

Capability unit Vs–7(22)

In this unit are deep, gently sloping to strongly sloping, very cobbly or very rocky soils. These soils are on ridges and side slopes. They formed in material from volcanic conglomerate, granitic rock, and metasedimentary schist and slate. The vegetation is mostly forests of conifers and hardwoods, but some areas have a dense understory of bracken fern and mountain misery, and a few areas are brushy.

The surface soil ranges from loam to sandy loam; the subsoil is mostly loam, clay loam, or clay. Permeability ranges from moderately rapid to moderately slow. Natural fertility is moderate. Cobblestones and rocks in the soils hinder cultivation.

The soils in this unit are—

CbC Cohasset very cobbly loam, 3 to 16 percent slopes.
CoC Cohasset very cobbly sandy loam, 3 to 16 percent slopes.
MvC Musick very rocky sandy loam, 9 to 16 percent slopes.
SrC Sites very rocky loam, 3 to 16 percent slopes.

Cobblestones and rock outcrops hinder cultivation of these soils. The soils are best suited to timber and produce high yields of trees of good quality if they are well managed. In some places cleared areas are used for grazing; forested areas provide browse and, in places, grazing.

Most areas of these soils have been logged two or three times, or more. In the present stands, young trees ought to be thinned to avoid overcrowding and larger trees pruned to obtain lumber that is fairly free of knots. If the soils are wet, trees should not be yarded or skidded. In locating roads and skid trails, the gradient ought to be low and adequate drainage and suitable outlets provided for runoff. Outsloping of temporary roads is advisable. Slash can be disposed of by cutting limbs in short lengths and scattering them. Placing slash in skid trails helps prevent gullies. If burning is necessary because of the fire hazard, the slash can be stacked in small piles and burned. The use of firebreaks and removal of slash from the understory of forests reduces danger of forest fires.

Capability unit VIe–1(18)

In this unit are rolling to hilly, moderately deep to deep soils. These soils formed in material from granitic rock. They are mainly in the Shenandoah Valley area, but a small acreage of Snelling soil is on terraces along the Mokelumne River. The vegetation is grass, grass-oak, scattered brush, and conifers.

The surface soil ranges from loam to coarse sandy loam and erodes readily if not protected. In some places the soils have been moderately eroded because of past farming practices.

These soils are—

AaD Ahwahnee loam, 16 to 31 percent slopes.
AaD2 Ahwahnee loam, 16 to 31 percent slopes, eroded.
SgD Sierra coarse sandy loam, 16 to 31 percent slopes.
SgD2 Sierra coarse sandy loam, 16 to 31 percent slopes, eroded

ShD Sierra coarse sandy loam, moderately deep, 16 to 31 percent slopes.
ShD2 Sierra coarse sandy loam, moderately deep, 16 to 31 percent slopes, eroded.
SwE Snelling sandy loam, 16 to 31 percent slopes.

These soils are best suited to grazing. In some places there are stands of conifers that can be managed for timber. Steep slopes and susceptibility to erosion make the soils poorly suited to crops that require frequent tillage.

In areas planted to orchards and vineyards, careful management is required to maintain yields and prevent erosion. Grasses and legumes, volunteer annual grasses and forbs, or other cover help control erosion during the rainy season. The cover can be disked under after the rains in late spring to help conserve soil moisture.

Capability unit VIe–9(18)

The soils in this unit are gently sloping to steep, moderately deep to shallow, and have low to very low fertility. These soils are underlain by extremely acid, clayey marine sediments and sandstone, or by consolidated alluvium. They are gently sloping to moderately steep and are on dissected terraces.

The texture of the surface soil ranges from gravelly and cobbly loam to coarse sandy loam. Permeability of the subsoil is slow to very slow. The Pardee soil in this unit is shallow over an impermeable substratum. In the Red Bluff and Mokelumne soils, the subsoil is fine textured and strongly acid to extremely acid.

These soils are—

MsD Mokelumne coarse sandy loam, 5 to 36 percent slopes.
PaD Pardee cobbly loam, 3 to 31 percent slopes.
RbE2 Red Bluff gravelly loam, 16 to 36 percent slopes, eroded; Mokelumne gravelly sandy loam, 16 to 36 percent slopes, eroded; in mapping unit RbE2, Red Bluff-Mokelumne complex, 16 to 36 percent slopes, eroded.

The slope, low fertility, strong acidity, and nearness of clay or impermeable layers to the surface make these soils some of the lowest producing rangeland in the Area. Forage grasses on these soils respond if large amounts of fertilizer that contains nitrogen and phosphate are applied. Nevertheless, in most places the increase in yields would probably not pay for the cost of reseeding and fertilizing. Thinning dense thickets of brush and oak increases yields of forage in some places.

Capability unit VIs–1(18)

This unit consists of rolling to hilly, very rocky, granitic soils. The vegetation is mostly grass-oak but includes scattered oaks and conifers. In some places the soils are moderately eroded.

The soils in this unit are—

AdD Ahwahnee very rocky loam, 9 to 31 percent slopes.
SkD Sierra very rocky coarse sandy loam, 16 to 31 percent slopes.
SmD Sierra very rocky coarse sandy loam, moderately deep, 9 to 31 percent slopes.

Rock outcrops and rolling to hilly slopes make these soils best suited to grazing. Generally, rock outcrops restrict the use of farm machinery. In some places there are conifers that can be managed for timber. Range in poor condition can be reseeded to more productive grasses and legumes if a seedbed is prepared and planting is done across the slope.

Capability unit VIs–1(22)

This unit consists of deep to very deep, hilly to steep, well-drained soils. These soils formed in material from volcanic conglomerate, granite, metasedimentary schist and slate, and other kinds of rock. On most of the areas there are stands of cutover timber.

Most of the soils in this unit are cobbly, very cobbly, or very rocky. The texture of the surface soil ranges from coarse sandy loam to loam, but it is predominantly loam. Generally, the subsoil contains more clay and is finer textured than the surface soil, but the McCarthy soil has little textural change throughout the profile.

Generally, these soils have high to very high water-holding capacity, but the Fiddletown soil has moderate water-holding capacity. In all the soils permeability is moderately rapid to moderate in the surface soil and moderate to moderately slow in the subsoil.

The soils in this unit are—

AkD Aiken cobbly loam, 16 to 31 percent slopes.
AkE Aiken cobbly loam, 31 to 51 percent slopes.
AmE Aiken very rocky loam, 16 to 51 percent slopes.
CbE Cohassett very cobbly loam, 16 to 51 percent slopes.
CoE Cohassett very cobbly sandy loam, 16 to 51 percent slopes.
FoE Fiddletown very rocky loam, 16 to 51 percent slopes.
FtE Fiddletown very rocky loam, deep, 16 to 51 percent slopes.
HkE Holland very rocky coarse sandy loam, deep, 16 to 51 percent slopes.
JnE Josephine loam, deep, 31 to 51 percent slopes.
JpE Josephine very rocky loam, deep, 16 to 51 percent slopes.
MkE McCarthy very rocky loam, 16 to 51 percent slopes.
MmE Jiggs very cobbly loam, 16 to 51 percent slopes; in mapping unit MmE, McCarthy and Jiggs very cobbly loam, 16 to 51 percent slopes.
MuD Musick sandy loam, 16 to 31 percent slopes.
MuE Musick sandy loam, 31 to 51 percent slopes.
MvE Musick very rocky sandy loam, 16 to 51 percent slopes.
SrE Sites very rocky loam, 16 to 51 percent slopes.
SnE Sites loam, 31 to 51 percent slopes.

These soils are too steep or rocky for cultivation, but most areas have browse on them and, in some places, grass suitable for grazing. The soils are well suited to trees. The growth rates of ponderosa pine and other conifers are among the best in the Area. Because of the steep slope, care is needed to prevent erosion when logging is done. If feasible, road gradients should not exceed 12 percent. Adequate ditches and culverts should be provided on main roads for control of runoff. Placing slash on landings and skid trails after logging helps prevent gullies.

Capability unit VIs–4(18)

In this unit the soils are shallow to bedrock, are gently sloping to hilly, are very rocky, and have moderate to low available water holding capacity. The vegetation is grass-oak, brush, and scattered digger pines.

In these soils permeability is mostly moderate to moderately slow, except for the Argonaut soil, which has a very slowly permeable clay subsoil. Fertility is mostly moderate. Generally, erosion is not a problem if adequate vegetation is left on the soils.

The soils in this unit are—

AoD Argonaut very rocky loam, 3 to 31 percent slopes.
AsB2 Auburn very rocky silt loam, 3 to 9 percent slopes, eroded.
AsD Auburn very rocky silt loam, 3 to 31 percent slopes.

EhD Exchequer loam, 3 to 31 percent slopes; in mapping unit EhD, Exchequer and Auburn loams, 3 to 31 percent slopes.

ExD Auburn very rocky loam, 3 to 31 percent slopes; in mapping unit ExD, Exchequer and Auburn very rocky loams, 3 to 31 percent slopes.

The soils in this unit comprise the largest acreage of soils used for range in the Area. Generally, rock outcrops on the surface restrict cultivation. Small areas between the outcrops can be reseeded to better producing grasses and legumes or can be periodically planted to hay and grain. If these soils are well managed, they produce moderate to moderately large amounts of usable forage. Applying nitrogen and phosphate increases forage production and extends the grazing period.

Capability unit VIs-4(22)

The soils in this unit are mostly shallow to bedrock, are very stony or very rocky, and have low water-holding capacity. These soils are on ridge crests. Most of them formed in material from metasedimentary rock. The vegetation consists of brush, of forests of conifers and hardwoods, and of open areas of grass.

The soils in this unit are—

IvE Iron Mountain very stony loam, rhyolite substratum, 9 to 51 percent slopes.

JxE Mariposa very rocky loam, 31 to 51 percent slopes; in mapping unit JxE, Josephine-Mariposa complex, 16 to 51 percent slopes.

McE Mariposa very rocky loam, 31 to 51 percent slopes.

McD Mariposa very rocky loam, 9 to 31 percent slopes.

MdE Mariposa very rocky loam, 16 to 51 percent slopes; in mapping unit MdE, Mariposa-Maymen complex, 16 to 51 percent slopes.

MhE Mariposa very rocky loam, 16 to 51 percent slopes; in mapping unit MhE, Maymen-Mariposa complex, 16 to 51 percent slopes.

StE Mariposa very rocky loam, 16 to 51 percent slopes; in mapping unit StE, Sites-Mariposa complex, 16 to 51 percent slopes.

These soils comprise a fairly large acreage of the brushland in the Area at elevations above 1,200 feet. Productivity is low, and the soils do not respond to intensive management.

In places, generally in those areas cleared by burning, grass is produced for livestock. Controlling brush on these areas is a problem, as brush quickly reinvades. Trees suitable for poles, firewood, fenceposts, or low-grade lumber grow in some places. The brushy areas serve as protected watershed and as habitat for wildlife.

Capability unit VIs-41(18)

The soils in this unit are steep, mostly shallow to bedrock, and have moderate to low available water holding capacity. The vegetation consists of grass-oak, brush, and a few digger pines. Outcroppings of rock are abundant. The texture of the surface soil ranges from loam to silt loam. Depth to bedrock ranges from 6 to 26 inches.

The permeability of these soils is moderate to moderately slow. Fertility is mostly moderate. The erosion hazard is very severe if the vegetative cover is inadequate or is destroyed by fire.

The soils in this unit are—

AsE Auburn very rocky silt loam, 31 to 51 percent slopes.

ExE Auburn very rocky loam, 31 to 51 percent slopes; in mapping unit ExE, Exchequer and Auburn very rocky loams, 31 to 51 percent slopes.

Steep slopes and rocks hinder cultivation of these soils. Management practices are somewhat more difficult to apply than on more gently sloping soils; deteriorated areas are difficult to reseed with farm machinery.

These soils are fairly extensive and comprise a fairly large part of the rangeland in the Area. If these soils are well managed and rainfall is adequate and favorably spaced, yields of forage are moderately high and the forage is of good quality. Yields increase if brush is removed and dense stands of oak are thinned. In places the slope is so steep that livestock trail around the slope rather than graze uniformly. Grazing should be spaced so that enough grass is left to protect the soils from erosion.

Capability unit VIs-49(18)

This unit consists of shallow, gently sloping to moderately steep soils that are subject to erosion. These soils formed mainly in material from rhyolitic tuff, but a small acreage formed in material from granitic rock.

The soils in this unit are droughty and have low available water holding capacity. The slope is mostly less than 31 percent. On the gently sloping areas the hazard of erosion is slight, but on steeper areas it is very severe. Fertility is low, and permeability is rapid to moderately rapid.

The soils in this unit are—

AeE Ahwahnee very rocky loam, shallow, 16 to 51 percent slopes.

PnC Pentz sandy loam, 2 to 16 percent slopes.

PnC2 Pentz sandy loam, 9 to 16 percent slopes, eroded.

PnD Pentz sandy loam, 16 to 31 percent slopes.

PpC Pentz gravelly sandy loam, 2 to 16 percent slopes.

These soils are used chiefly for range. Yields are low, and range plants on these soils do not respond to intensive management. Except for the Ahwahnee soil and the gravelly Pentz soil, most areas are fairly free of rock. In places the gently sloping soils have been planted to dryland orchard, but these orchards are now abandoned because of low yields and difficulties of management. A small acreage is periodically planted to hay and grain.

Capability unit VIs-8(18)

The soils in this unit are moderately deep to bedrock, gently sloping to hilly, and very rocky or very cobbly. The Argonaut part of the Auburn-Argonaut complex has a subsoil of very slowly permeable clay.

The soils in this unit are—

AtD Auburn very rocky silt loam, moderately deep, 3 to 31 percent slopes.

AxD Auburn very rocky silt loam, 3 to 31 percent slopes; Argonaut very rocky silt loam, 3 to 31 percent slopes; in mapping unit AxD, Auburn-Agronaut very rocky silt loams, 3 to 31 percent slopes.

SyD Supan very cobbly loam, moderately deep, 3 to 31 percent slopes.

Rock outcrops generally restrict cultivation of these soils. These soils are, therefore, better suited to range than to other uses. They comprise some of the most highly productive rangeland in the Area, and the range responds to good management. Better producing grasses and legumes, including perennials, can be reseeded on range in poor condition if a satisfactory seedbed can be prepared. Range plants on these soils respond well if fertilizer that contains nitrogen and phosphate is applied.

If irrigation water is available, these soils are suitable for irrigated pasture.

Capability unit VIs–8(22)

The soils in this unit are moderately deep to bedrock, are gently sloping to rolling, and are very cobbly or very rocky. The bedrock is variable, but it is mostly volcanic conglomerate, metasedimentary slate and schist, and granitic rock. These soils are on ridges and foot slopes, or in swales. The vegetation is conifers, hardwoods, brush, and grass.

In these soils permeability ranges from moderately rapid to moderately slow. Fertility is mostly moderate.

The soils in this unit are—

- CcC Cohasset very cobbly loam, moderately deep, 3 to 16 percent slopes.
- HfD Holland very rocky coarse sandy loam, 9 to 16 percent slopes.
- JoC Josephine very rocky loam, 3 to 16 percent slopes.
- MlC McCarthy very cobbly loam, 3 to 16 percent slopes.
- WcD Windy cobbly sandy loam, 9 to 16 percent slopes.

Cobblestones and rocks restrict use of these soils to timber and grazing. Cleared areas are generally revegetated with grass and used for grazing, but in time, most open areas are invaded by brush. If water is available, a small acreage of the Josephine and Holland soils could be used for irrigated pasture.

Trees on these soils grow at a moderate rate.

Capability unit VIs–81(18)

The soils in this unit are moderately deep, steep, and very rocky or very cobbly. The texture of the surface soil ranges from loam to silt loam. The subsoil is moderately fine textured or fine textured. Below is bedrock, mainly metabasic and metasedimentary slate and schist and volcanic conglomerate. The vegetation is mainly grass-oak, but it includes brush and scattered digger pines.

These soils have moderate available water holding capacity. Permeability is moderate to moderately slow. Fertility is moderate to moderately high. The erosion hazard is very severe if these soils are not adequately protected by vegetation.

The soils in this unit are—

- AtE Auburn very rocky silt loam, moderately deep, 31 to 51 percent slopes.
- SyE Supan very cobbly loam, moderately deep, 31 to 51 percent slopes.

Steep slopes, rocks, and cobblestones hinder cultivation of these soils. These soils are well suited to grazing, however, and if they are well managed, yields of high-quality forage are good. Control of brush is generally not economically feasible on these soils.

Capability unit VIs–81(22)

In this unit are moderately deep, hilly to steep, generally very rocky or very cobbly soils. These soils formed in material from volcanic conglomerate and tuff, metasedimentary slate and schist, granitic rock, and limestone. The vegetation is conifers, hardwoods, brush, and grass. These soils make up the largest acreage in the Area used for timber. The texture of the surface soil ranges from coarse sandy loam to loam, but it is mostly loam. In most of the soils, the subsoil is finer textured than the surface soil, but the McCarthy and Windy soils have about the same texture throughout the profile. Permeability of the soils ranges from moderately rapid to moderately slow. Fertility is mostly moderate.

The soils in this unit are—

- CcE Cohasset very cobbly loam, moderately deep, 16 to 51 percent slopes.
- HcE Holland coarse sandy loam, 16 to 36 percent slopes.
- HfE Holland very rocky coarse sandy loam, 16 to 51 percent slopes.
- JgE Jiggs very rocky loam, 16 to 51 percent slopes.
- JmE Josephine loam, 31 to 51 percent slopes.
- JoE Josephine very rocky loam, 16 to 51 percent slopes.
- JsE Josephine very rocky loam, 16 to 51 percent slopes; in mapping unit JsE, Josephine-Maymen complex, 16 to 51 percent slopes.
- JxE Josephine very rocky loam, 16 to 51 percent slopes; in mapping unit JxE, Josephine-Mariposa complex, 16 to 51 percent slopes.
- MmE McCarthy very cobbly loam, 16 to 51 percent slopes; in mapping unit MmE, McCarthy and Jiggs very cobbly loams, 16 to 51 percent slopes.
- MwE Musick very rocky sandy loam, moderately deep, 16 to 51 percent slopes.
- SoE Sites loam, moderately deep, 31 to 51 percent slopes.
- SsE Sites very rocky loam, moderately deep, 16 to 51 percent slopes.
- StE Sites very rocky loam, moderately deep, 16 to 51 percent slopes; in mapping unit StE, Sites-Mariposa complex, 16 to 51 percent slopes.
- TcE Tiger Creek very rocky loam, 16 to 51 percent slopes.
- WcE Windy cobbly sandy loam, 16 to 51 percent slopes.

These soils are used mostly for timber and grazing. They are only moderately productive of timber; nevertheless, the growing of timber is the most suitable and profitable use for these soils. Moderately steep and steep slopes and rocks hinder cultivation. Cleared areas, or areas where vegetation has been destroyed by fire, are commonly revegetated by grass, which in time is displaced by brush, and eventually timber. Some cleared or burned areas have dense stands of brush or mixed stands of young conifers, brush, and grass. Restocking of conifers is generally by natural reproduction, but hand planting is necessary in some areas. When areas are logged, a suitable number of trees should be left to provide seed for reproduction. Deer, porcupines, and rabbits damage young trees and should be controlled.

Capability unit VIIs–1(18)

In this unit are rolling to very steep, moderately coarse textured or medium textured, very rocky soils subject to erosion. These soils formed in material from granitic rock. They are mostly moderately deep to bedrock. Most areas have a cover of grass and oak and some brush, but in places near the limits of the higher elevations, there are ponderosa pines and other conifers.

Although slopes range mostly from 31 to 71 percent, some of the soils have gentler slopes and have been severely eroded because of poor management. The severely eroded soils have gullies in places and have low fertility. All of the soils have rock outcrops.

The soils in this unit are—

- AdD3 Ahwahnee very rocky loam, 16 to 31 percent slopes, severely eroded.
- AdE Ahwahnee very rocky loam, 31 to 51 percent slopes.
- SkF Sierra very rocky coarse sandy loam, 51 to 71 percent slopes.
- SmE Sierra very rocky coarse sandy loam, moderately deep, 31 to 51 percent slopes.
- SlD3 Sierra sandy clay loam, 9 to 31 percent slopes, severely eroded.

These soils are used principally for grazing, but timber is produced in some places. The soils should not be grazed when too wet. It is difficult to get uniform grazing

on the very steep soils. On the severely eroded soils, productivity is low and special management practices are required. Gullies can be filled and fertilizer applied to help restore productivity. Grazing should be deferred or regulated to allow regrowth of vegetation. On some of the less steep slopes, shallow tillage can be used to prepare seedbeds and the areas then can be reseeded by broadcasting.

Capability unit VIIs-1(22)

The soils in this unit are deep, very steep and very rocky, or very cobbly. These soils are on slopes of canyons. On most areas there are scattered stands or pockets of timber, and some areas are very brushy. If logging is carelessly done, or if the cover is destroyed by fire, the erosion hazard is very severe.

The soils in this unit are—

- AmF Aiken very rocky loam, 51 to 71 percent slopes.
- CbF Cohasset very cobbly loam, 51 to 71 percent slopes.
- JpF Josephine very rocky loam, deep, 51 to 71 percent slopes.
- MkF McCarthy very rocky loam, 51 to 71 percent slopes.
- MvF Musick very rocky sandy loam, 51 to 71 percent slopes.
- ScF Shaver very rocky coarse sandy loam, 51 to 71 percent slopes.
- SrF Sites very rocky loam, 51 to 85 percent slopes.

Very steep slopes and rocks restrict the use of these soils to timber and light grazing by livestock. Some areas are inaccessible, and these are best maintained as protected watershed and browse areas for wildlife.

Logging procedures vary on these soils. Where the stands are thin and the trees are scattered, logging is generally done by tractor. The trees are skidded to landings and hauled by truck if roads are accessible. Larger tracts that have dense stands of trees are generally logged by high-line leads that snake the logs out by the use of cables and donkey engines. The steep slopes make harvesting of trees hazardous and difficult. When trees are harvested, they should be selectively cut and an adequate number of trees left to provide seed for reproduction. Placing slash in skid trails helps control erosion.

Outsloping of temporary roads is needed for disposal of runoff water. If feasible, major roads should be located on ridgetops or on flat areas adjacent to drainageways. The gradient should be less than 12 percent. Culverts or structures for diverting water help remove runoff safely.

Fire protection is difficult, but adequate facilities for detection of fire are generally available from Federal and State forest services.

Capability unit VIIs-4(18)

The soils in this unit are very shallow, nearly level to very steep, and generally very rocky or very stony. Depth to bedrock is less than 10 inches in most places. In most of the soils rock outcrops and rock fragments are abundant, but in the Pentz soil they are few. The texture of the soils ranges from sandy loam and silt loam to loam. Generally, the vegetation consists of dense stands of brush and oak, but in places there are open areas of grass and scattered digger pines and ponderosa pines.

These soils are somewhat excessively drained. They have very low water-holding capacity and low fertility. The erosion hazard ranges from moderate to very severe.

The soils in this unit are—

- EcD Exchequer very rocky silt loam, 3 to 31 percent slopes.
- EcE Exchequer very rocky silt loam, 31 to 51 percent slopes.
- ExD Exchequer very rocky loam, 3 to 31 percent slopes; in Exchequer and Auburn very rocky loams, 3 to 31 percent slopes.
- ExE Exchequer very rocky loam, 31 to 51 percent slopes; in mapping unit ExE, Exchequer and Auburn very rocky loams, 31 to 51 percent slopes.
- IrE Inks loam, 3 to 45 percent slopes; in mapping unit IrE, Inks loam and Rock land, 3 to 45 percent slopes.
- IsE Iron Mountain very stony loam, 9 to 51 percent slopes.
- PoE Pentz sandy loam, very shallow, 2 to 51 percent slopes.

Grazing on these soils is limited mainly to areas free of brush. Brushy areas furnish food and cover for wildlife. Areas adjacent to the Pardee Reservoir are used partly for recreation.

Yields of forage are low on these soils; the plants dry up early in spring when the first extended warm spells occur. Control of brush is also a problem.

Capability unit VIIs-4(22)

This unit consists of very shallow, rolling to very steep, very rocky soils. These soils formed in material from slate, schist, and other metasedimentary rock, and from volcanic conglomerate. They are mostly on ridge crests at high elevations. Most areas have a cover of brush and scattered dwarfed conifers, but some areas are bare of vegetation and contain large areas of rock. Areas that have been cleared or burned over have a scanty cover of grass. The soils in this unit are droughty. They have very low water-holding capacity.

The soils in this unit are—

- IsE Iron Mountain very stony loam, 9 to 51 percent slopes.
- JsE Maymen very rocky loam, 16 to 51 percent slopes; in mapping unit JsE, Josephine-Maymen complex, 16 to 51 percent slopes.
- MdE Maymen very rocky loam, 16 to 51 percent slopes; in mapping unit MdE, Mariposa-Maymen complex, 16 to 51 percent slopes.
- MgE Maymen very rocky loam, 9 to 51 percent slopes.
- MhE Maymen very rocky loam, 16 to 51 percent slopes; in mapping unit MhE, Maymen-Mariposa complex, 16 to 51 slopes.

These soils have value for woodland and range in some places. Areas in brush serve as protected watershed and provide browse and cover for wildlife.

Capability unit VIIs-41(22)

The soils in this unit are shallow to bedrock and are very steep and very rocky. They are on side slopes and crests of ridges. The vegetation consists of brush, of grass in open areas, and of scattered conifers.

The soils in this unit are—

- McF Mariposa very rocky loam, 51 to 85 percent slopes.
- MdF Mariposa very rocky loam, 51 to 85 percent slopes; Maymen very rocky loam, 51 to 85 percent slopes; in mapping unit MdF, Mariposa-Maymen complex, 51 to 85 percent slopes.

Most areas of these soils are best suited to limited grazing, to use as protected watershed, or to provide areas for wildlife. Trees generally grow slowly on these soils and are of poor quality. Firewood, poles, and fenceposts can be cut from the woodlands in places.

Capability unit VIIs-7(18)

This unit consists of moderately deep to shallow, rolling to very steep, extremely rocky soils. These soils formed mainly in material from metabasic igneous rock, but partly in material from granitic rock.

Rock outcrops occupy from 30 to 60 percent of the surface area. The texture of the surface soil ranges from loam to silt loam. Depth to bedrock is variable. Most areas of these soils are small and are surrounded by soils that are more productive. In some areas there are dense stands of brush.

The soils in this unit are—

AfD Ahwahnee extremely rocky loam, 9 to 51 percent slopes.
AuD Auburn extremely rocky silt loam, 3 to 31 percent slopes.
AuF Auburn extremely rocky silt loam, 31 to 71 percent slopes.
AvE Auburn extremely rocky silt loam, moderately deep, 31 to 71 percent slopes.

These soils are used for range or to provide cover and feed for wildlife and shaded areas for livestock. Forage is limited to areas between the rocks.

Capability unit VIIs–81(22)

The soils in this unit are moderately deep to bedrock and are hilly to very steep. Most areas are very rocky, but some granitic areas are extremely rocky. These soils formed in material from granitic rock and from metasedimentary schist and slate. Much of the acreage is on canyon slopes adjacent to the Mokelumne and Cosumnes Rivers. The soils are similar to those in capability unit VIs–81(22), but they are steeper.

The soils in this unit are—

FoF Fiddletown very rocky loam, 51 to 71 percent slopes.
HfF Holland very rocky coarse sandy loam, 51 to 71 percent slopes.
JoF Josephine very rocky loam, 51 to 71 percent slopes.
JxF Josephine very rocky loam, 51 to 71 percent slopes; Mariposa very rocky loam, 51 to 71 percent slopes; in mapping unit JxF, Josephine-Mariposa complex, 51 to 71 percent slopes.
MwF Musick very rocky sandy loam, moderately deep, 51 to 71 percent slopes.
MxF Musick extremely rocky sandy loam, moderately deep, 51 to 71 percent slopes.
SdF Shaver very rocky coarse sandy loam, moderately deep, 51 to 71 percent slopes.

Steep slopes, rocks, and moderate depth to bedrock severely limit the use of these soils for agriculture. In addition, some areas are not accessible to roads. The soils are used for timber, to which they are best suited, and in places for light grazing. Areas that have a dense cover of brush are maintained as protected watershed and as browse areas for wildlife.

Capability unit VIIs–9(18)

Only one soil is in this unit. It is very shallow, is very rocky, and has very low fertility. This soil formed mainly in material from serpentine rock. Some small areas included with this soil consist of clay-textured alluvium derived from serpentine rock and other kinds of rock; these areas are shown on the map by a clay-spot symbol. Generally, dense stands of brush cover areas of this soil.

This soil has low water-holding capacity. The very low fertility is partly caused by the high content of magnesium in the soil, which displaces the calcium and makes the soil toxic.

The soil in this unit is—

HaD Henneke very rocky loam, 3 to 51 percent slopes.

This soil has limited value for grazing. It is used for range, as browse areas for wildlife, or as protected watershed. Protecting the areas from fire helps prevent erosion and subsequent pollution of streams because of debris from runoff.

Capability unit VIIs–0(18 and 22)

Only one land type is in this unit. It consists of stony, cobbly, and gravelly material in riverbeds, mined areas, and placer diggings. Generally, there is enough fine material to support some grass for grazing by livestock. The slope is mainly less than 16 percent. Most areas in streambeds are subject to frequent flooding during the rainy period.

This land type is—

Pw Placer diggings and Riverwash.

This land type is fairly variable in depth, in the number of stones it contains, and in slope. The amount of forage produced also varies. Therefore, management requirements are best determined at the particular site. This land type provides shade and watering areas for livestock, produces food and cover for wildlife, and serves as watershed areas. In some places trees can be cut for lumber.

Capability unit VIIIs–8(18)

This unit consists mostly of very shallow and extremely rocky land types with large areas of exposed bedrock. Some areas consist of piles of mine tailings or of mounds of material left from dredging. These land types are fairly extensive, and they make up about 12 percent of the total acreage of the Area. In some places the vegetation is a scanty cover of grass with a few scattered oaks and digger pines, and in other places there are dense stands of brush.

The land types in this unit are—

Mn Mine tailings and Riverwash.
IrE Rock land; in mapping unit IrE, Inks loam and Rock land, 3 to 45 percent slopes.
RmD Mine pits; in mapping unit RmD, Red Bluff-Mokelumne-Mine pits complex, 2 to 16 percent slopes.
Ro Rock land.
Sa Sedimentary rock land.
Sb Serpentine rock land.

These land types produce little forage. They need to be protected from fire, however, because of their value as watershed. The areas furnish food and cover for wildlife, especially for deer and game birds, and also for some fur bearers. Areas adjacent to streams or reservoirs provide foundation sites for dams or are part of a reservoir area. Shoreline areas can be used for recreation.

Capability unit VIIIs–8(22)

This unit consists of very shallow, extremely rocky or stony land types.

These land types are—

Ln Limestone rock land.
Mn Mine tailings and Riverwash.
Ro Rock land.

These land types have little value for agriculture, except for protected watershed and for browse areas for wildlife. Protecting the areas from fire helps prevent erosion and subsequent pollution of rivers and streams by debris from runoff.

Storie Index Rating

The soils of the Area are arranged in alphabetic order in table 3 and are rated according to the Storie index (*6, 24*). This index expresses numerically the relative degree of suitability or value of a soil for general intensive agriculture. The rating is based on soil characteristics only and is obtained by evaluating such factors as depth, texture of the surface soil and density of subsoil, drainage, alkali content, and relief. Other factors, such as availability of water for irrigation, climate, and distance from markets, that might determine the desirability of growing certain plants in a given locality, are not considered. Therefore, in itself the index cannot be considered as an index of land evaluation.

Four general factors are considered in the index rating. These factors are (A) the characteristics of the soil profile and soil depth; (B) the texture of the surface soil; (C) slope; and (X) other factors, such as drainage, alkali, and erosion. Each of these four general factors is evaluated on the basis of 100 percent. A rating of 100 percent expresses the most favorable, or ideal, condition, and lower percentage ratings are given for conditions that are less favorable for crop production.

The index rating for a soil is obtained by multiplying the four factors, A, B, C, and X; thus, any one factor may dominate or control the final rating. As an example, a soil may have an excellent profile justifying a rating of 100 percent for factor A, excellent surface soil conditions justifying 100 percent for factor B, a smooth, nearly level surface justifying 100 percent for factor C, but a high accumulation of salts or alkali that would give a rating of 10 percent for factor X. Multiplying these four ratings gives an index rating of 10 for this soil. The high accumulation of salts would dominate the quality of the soil, render it unproductive for crops, and justify the low index rating of 10.

Soils are placed in grades according to their suitability for general intensive agriculture as shown by their Storie index ratings. The six grades and their range in index ratings are:

	Index rating
Grade 1	80 to 100
Grade 2	60 to 80
Grade 3	40 to 60
Grade 4	20 to 40
Grade 5	10 to 20
Grade 6	less than 10

Soils of grade 1 are excellent, or well suited to general intensive agriculture. Grade 2 soils are good and are also well suited to agriculture, although they are not so desirable as soils of grade 1. Grade 3 soils are only fairly well suited, grade 4 soils are poorly suited, and grade 5 soils are very poorly suited. Grade 6 consists of soils and land types that are not suited to agriculture.

TABLE 3.—*Storie index rating for soils of the Amador Area, Calif.*

Map symbol	Soil	Factor A (profile)	Factor B (texture)	Factor C (slope)	Factor X (other conditions)	Index rating	Grade
AdD	Ahwahnee very rocky loam, 9 to 31 percent slopes	60	30	80	100	14	5
AaB	Ahwahnee loam, 3 to 9 percent slopes	60	100	90	100	54	3
AaB2	Ahwahnee loam, 3 to 9 percent slopes, eroded	60	100	90	80	43	3
AaC	Ahwahnee loam, 9 to 16 percent slopes	60	100	85	100	51	3
AaC2	Ahwahnee loam, 9 to 16 percent slopes, eroded	60	100	85	80	41	3
AaD	Ahwahnee loam, 16 to 31 percent slopes	60	90	70	100	38	4
AaD2	Ahwahnee loam, 16 to 31 percent slopes, eroded	60	90	70	70	26	4
AdD3	Ahwahnee very rocky loam, 16 to 31 percent slopes, severely eroded	60	30	70	60	8	6
AdE	Ahwahnee very rocky loam, 31 to 51 percent slopes	60	30	40	100	7	6
AfD	Ahwahnee extremely rocky loam, 9 to 51 percent slopes	60	20	60	100	7	6
AeE	Ahwahnee very rocky loam, shallow, 16 to 51 percent slopes	40	30	60	100	7	6
AkC	Aiken cobbly loam, 3 to 16 percent slopes	100	50	85	80	34	4
AhB	Aiken loam, 3 to 9 percent slopes	100	100	90	80	72	2
AhC	Aiken loam, 9 to 16 percent slopes	100	100	80	80	64	2
AkD	Aiken cobbly loam, 16 to 31 percent slopes	100	50	70	80	28	4
AkE	Aiken cobbly loam, 31 to 51 percent slopes	100	50	40	80	16	5
AmE	Aiken very rocky loam, 16 to 51 percent slopes	80	40	50	80	13	5
AmF	Aiken very rocky loam, 51 to 71 percent slopes	80	40	20	80	5	6
AoD	Argonaut very rocky loam, 3 to 31 percent slopes	50	30	80	80	10	5
AnD	Argonaut gravelly loam, 3 to 31 percent slopes	50	70	80	80	22	4
AsD	Auburn very rocky silt loam, 3 to 31 percent slopes	40	30	75	100	9	6
ApD	Auburn silt loam, 0 to 31 percent slopes	40	100	80	100	32	4
AsB2	Auburn very rocky silt loam, 3 to 9 percent slopes, eroded	40	30	85	80	8	6
AsE	Auburn very rocky silt loam, 31 to 51 percent slopes	40	30	30	100	4	6
AuD	Auburn extremely rocky silt loam, 3 to 31 percent slopes	40	20	75	100	6	6
AuF	Auburn extremely rocky silt loam, 31 to 71 percent slopes	40	20	30	100	2	6
ArC	Auburn silt loam, moderately deep, 3 to 16 percent slopes	60	100	90	100	54	3
ArD	Auburn silt loam, moderately deep, 16 to 31 percent slopes	60	100	70	100	42	3
AtD	Auburn very rocky silt loam, moderately deep, 3 to 31 percent slopes	60	30	75	100	14	5
AtE	Auburn very rocky silt loam, moderately deep, 31 to 51 percent slopes	60	30	30	100	5	6
AvE	Auburn extremely rocky silt loam, moderately deep, 31 to 71 percent slopes	60	20	30	100	4	6
AwC	Auburn-Argonaut silt loams, 0 to 16 percent slopes	50	100	85	90	38	4
AxD	Auburn-Argonaut very rocky silt loams, 3 to 31 percent slopes	50	30	75	90	10	5

See footnotes at end of table.

TABLE 3.—*Storie index rating for soils of the Amador Area, Calif.*—Continued

Map symbol	Soil	Factor A (profile)	Factor B (texture)	Factor C (slope)	Factor X (other conditions)	Index rating	Grade
CbE	Cohasset very cobbly loam, 16 to 51 percent slopes	80	40	60	80	15	5
CaC	Cohasset loam, 5 to 16 percent slopes	80	100	85	80	54	3
CaD	Cohasset loam, 16 to 31 percent slopes	80	100	75	80	48	3
CbC	Cohasset very cobbly loam, 3 to 16 percent slopes	80	40	85	80	22	4
CbF	Cohasset very cobbly loam, 51 to 71 percent slopes	70	40	20	80	4	6
CcC	Cohasset very cobbly loam, moderately deep, 3 to 16 percent slopes	60	40	85	80	16	5
CcE	Cohasset very cobbly loam, moderately deep, 16 to 51 percent slopes	60	40	60	80	12	5
CoC	Cohasset very cobbly sandy loam, 3 to 16 percent slopes	80	35	85	80	19	5
CoE	Cohasset very cobbly sandy loam, 16 to 51 percent slopes	80	35	60	80	13	5
EcD	Exchequer very rocky silt loam, 3 to 31 percent slopes	20	30	80	100	5	6
EcE	Exchequer very rocky silt loam, 31 to 51 percent slopes	20	30	30	100	2	6
EhD	Exchequer and Auburn loams, 3 to 31 percent slopes	30	100	70	100	21	4
ExD	Exchequer and Auburn very rocky loams, 3 to 31 percent slopes	30	30	70	100	6	6
ExE	Exchequer and Auburn very rocky loams, 31 to 51 percent slopes	25	30	40	100	3	6
FoE	Fiddletown very rocky loam, 16 to 51 percent slopes	60	30	40	100	7	6
FgB	Fiddletown gravelly loam, deep, 3 to 10 percent slopes	75	70	95	100	50	3
FtE	Fiddletown very rocky loam, deep, 16 to 51 percent slopes	75	30	60	100	14	5
FdC	Fiddletown gravelly loam, 9 to 16 percent slopes	60	70	85	100	36	4
FdD	Fiddletown gravelly loam, 16 to 31 percent slopes	60	70	75	100	32	4
FoF	Fiddletown very rocky loam, 51 to 71 percent slopes	60	30	20	100	4	6
HaD	Henneke very rocky loam, 3 to 51 percent slopes	20	30	60	100	4	6
HdD	Holland coarse sandy loam, deep, 9 to 16 percent slopes	75	80	80	90	43	3
HdC	Holland coarse sandy loam, deep, 5 to 9 percent slopes	80	80	85	90	49	3
HkE	Holland very rocky coarse sandy loam, deep, 16 to 51 percent slopes	75	30	60	90	12	5
HcC	Holland coarse sandy loam, 5 to 9 percent slopes	60	80	85	90	37	4
HcD	Holland coarse sandy loam, 9 to 16 percent slopes	60	80	80	90	35	4
HcE	Holland coarse sandy loam, 16 to 36 percent slopes	50	80	65	90	23	4
HfD	Holland very rocky coarse sandy loam, 9 to 16 percent slopes	60	30	80	90	13	5
HfE	Holland very rocky coarse sandy loam, 16 to 51 percent slopes	50	30	60	90	8	6
HfF	Holland very rocky coarse sandy loam, 51 to 71 percent slopes	50	30	30	90	4	6
Ho	Honcut very fine sandy loam	100	100	100	100	100	1
Hs	Honcut very fine sandy loam, moderately well drained	90	100	100	90	81	1
Hv	Honcut very fine sandy loam, channeled	90	90	100	40	32	4
Hn	Honcut silt loam	100	100	100	100	100	1
Hm	Honcut clay loam, over clay	80	85	100	90	61	2
IdC	Inks loam, deep variant, 3 to 16 percent slopes	60	100	85	100	51	3
IrE	Inks loam, and Rock land, 3 to 45 percent slopes	30	30	50	100	5	6
IsE	Iron Mountain very stony loam, 9 to 51 percent slopes	30	30	40	100	4	6
IvE	Iron Mountain very stony loam, rhyolite substratum, 9 to 51 percent slopes	40	30	60	100	7	6
JgE	Jiggs very rocky loam, 16 to 51 percent slopes	60	30	60	100	11	5
JoE	Josephine very rocky loam, 16 to 51 percent slopes	60	30	40	90	6	6
JnC	Josephine loam, deep, 9 to 16 percent slopes	90	100	85	90	69	2
JnD	Josephine loam, deep, 16 to 31 percent slopes	90	100	70	90	57	3
JnE	Josephine loam, deep, 31 to 51 percent slopes	80	90	30	90	19	5
JpE	Josephine very rocky loam, deep, 16 to 51 percent slopes	80	30	60	90	13	5
JpF	Josephine very rocky loam, deep, 51 to 71 percent slopes	80	30	20	90	4	6
JmC	Josephine loam, 3 to 16 percent slopes	70	100	90	90	57	3
JmD	Josephine loam, 16 to 31 percent slopes	70	100	70	90	44	3
JmE	Josephine loam, 31 to 51 percent slopes	60	95	30	90	15	5
JoC	Josephine very rocky loam, 3 to 16 percent slopes	60	30	80	90	13	5
JoF	Josephine very rocky loam, 51 to 71 percent slopes	60	30	20	90	3	6
JxE	Josephine-Mariposa complex, 16 to 51 percent slopes	50	90	40	90	16	5
JxF	Josephine-Mariposa complex, 51 to 71 percent slopes	50	80	20	90	7	6
JsE	Josephine-Maymen complex, 16 to 51 percent slopes	40	50	40	90	7	6
LaC	Laniger sandy loam, 2 to 16 percent slopes	60	95	85	80	39	4
LgB	Laniger sandy loam, thick surface, 0 to 5 percent slopes	60	95	95	80	43	3
Ln	Limestone rock land					[1] 1	6
Lo	Loamy alluvial land	90	100	95	90	77	2
Ma	Made land		[2]			[1] 20–40	4
MeE	Mariposa very rocky loam, 31 to 51 percent slopes	40	30	30	90	3	6
MbD	Mariposa gravelly loam, 3 to 31 percent slopes	40	70	80	90	20	4
McD	Mariposa very rocky loam, 9 to 31 percent slopes	40	30	70	90	8	6
McF	Mariposa very rocky loam, 51 to 85 percent slopes	40	30	20	90	2	6
MdE	Mariposa-Maymen complex, 16 to 51 percent slopes	30	30	40	90	3	9
MdF	Mariposa-Maymen complex, 51 to 85 percent slopes	30	30	20	90	2	6
MgE	Maymen very rocky loam, 9 to 51 percent slopes	20	30	50	90	3	6
MhE	Maymen-Mariposa complex, 16 to 51 percent slopes	30	40	40	90	4	6
MlC	McCarthy very cobbly loam, 3 to 16 percent slopes	60	30	90	100	16	5

See footnotes at end of table.

TABLE 3.—*Storie index rating for soils of the Amador Area, Calif.*—Continued

Map symbol	Soil	Factor A (profile)	Factor B (texture)	Factor C (slope)	Factor X (other conditions)	Index rating	Grade
MkE	McCarthy very rocky loam, 16 to 51 percent slopes	70	30	40	100	8	6
MkF	McCarthy very rocky loam, 51 to 71 percent slopes	70	30	20	100	4	6
MmE	McCarthy and Jiggs very cobbly loams, 16 to 51 percent slopes	60	30	75	100	14	5
Mn	Mine tailings and Riverwash					[1] 1	6
Mo	Mixed alluvial land		[2]			[1] 20–40	4
Mp	Mixed wet alluvial land		[2]			[1] 20–40	4
MrB	Mokelumne sandy loam, 2 to 5 percent slopes	60	95	95	70	38	4
MsD	Mokelumne coarse sandy loam, 5 to 36 percent slopes	50	90	80	70	25	4
Mt	Mokelumne soils and Alluvial land	60	90	90	70	34	4
MvE	Musick very rocky sandy loam, 16 to 51 percent slopes	85	30	40	80	8	6
MuB	Musick sandy loam, 3 to 9 percent slopes	85	95	95	80	61	2
MuC	Musick sandy loam, 9 to 16 percent slopes	85	95	80	80	52	3
MuD	Musick sandy loam, 16 to 31 percent slopes	85	95	70	80	45	3
MuE	Musick sandy loam, 31 to 51 percent slopes	85	95	30	80	19	5
MvC	Musick very rocky sandy loam, 9 to 16 percent slopes	85	30	80	80	16	5
MvF	Musick very rocky sandy loam, 51 to 71 percent slopes	85	30	20	80	4	6
MwE	Musick very rocky sandy loam, moderately deep, 16 to 51 percent slopes	70	30	40	80	7	6
MwF	Musick very rocky sandy loam, moderately deep, 51 to 71 percent slopes	70	30	20	80	3	6
MxF	Musick extremely rocky sandy loam, moderately deep, 51 to 71 percent slopes	70	20	20	80	2	6
PaD	Pardee cobbly loam, 3 to 31 percent slopes	50	60	70	90	19	5
PnC	Pentz sandy loam, 2 to 16 percent slopes	40	95	85	80	26	4
PnC2	Pentz sandy loam, 9 to 16 percent slopes, eroded	30	95	80	70	16	5
PnD	Pentz sandy loam, 16 to 31 percent slopes	35	95	70	70	16	5
PpC	Pentz gravelly sandy loam, 2 to 16 percent slopes	35	60	85	70	12	5
PoE	Pentz sandy loam, very shallow, 2 to 51 percent slopes	20	95	60	70	8	6
PrA	Perkins loam, 0 to 3 percent slopes	85	100	100	90	77	2
PrC	Perkins loam, 3 to 16 percent slopes	85	100	85	90	65	2
PtB	Peters clay, 3 to 9 percent slopes	60	60	95	100	34	4
Pw	Placer diggings and Riverwash		[2]			[1] 0–5	6
RbD	Red Bluff-Mokelumne complex, 5 to 16 percent slopes	60	70	90	80	30	4
RbB	Red Bluff-Mokelumne complex, 0 to 5 percent slopes	60	70	100	80	34	4
RbE2	Red Bluff-Mokelumne complex, 16 to 36 percent slopes, eroded	60	70	70	70	21	4
RmD	Red Bluff-Mokelumne-Mine pits complex, 2 to 16 percent slopes	60	70	90	50	19	5
Ro	Rock land					[1] 1	6
RyA	Ryer silty clay loam, 0 to 3 percent slopes	80	100	100	90	72	2
Sa	Sedimentary rock land					[1] 1	6
Sb	Serpentine rock land					[1] 1	6
ScF	Shaver very rocky coarse sandy loam, 51 to 71 percent slopes	80	30	20	100	5	6
SdF	Shaver very rocky coarse sandy loam, moderately deep, 51 to 71 percent slopes	60	30	20	100	4	6
SfB	Shenandoah loam, 3 to 9 percent slopes	50	100	95	90	43	3
SgC	Sierra coarse sandy loam, 9 to 16 percent slopes	80	80	80	90	46	3
SgB	Sierra coarse sandy loam, 3 to 9 percent slopes	80	80	95	90	55	3
SgB2	Sierra coarse sandy loam, 3 to 9 percent slopes, eroded	80	80	95	85	49	3
SgC2	Sierra coarse sandy loam, 9 to 16 percent slopes, eroded	80	80	80	85	43	3
SgD	Sierra coarse sandy loam, 16 to 31 percent slopes	80	80	65	90	37	4
SgD2	Sierra coarse sandy loam, 16 to 31 percent slopes, eroded	80	80	65	85	35	4
SkD	Sierra very rocky coarse sandy loam, 16 to 31 percent slopes	80	30	65	85	13	5
SkF	Sierra very rocky coarse sandy loam, 51 to 71 percent slopes	70	30	20	85	3	6
ShB	Sierra coarse sandy loam, moderately deep, 3 to 9 percent slopes	60	80	95	90	41	3
ShB2	Sierra coarse sandy loam, moderately deep, 3 to 9 percent slopes, eroded	60	80	95	90	41	3
ShC	Sierra coarse sandy loam, moderately deep, 9 to 16 percent slopes	60	80	80	90	35	4
ShC2	Sierra coarse sandy loam, moderately deep, 9 to 16 percent slopes, eroded	60	80	80	85	33	4
ShD	Sierra coarse sandy loam, moderately deep, 16 to 31 percent slopes	60	80	65	90	28	4
ShD2	Sierra coarse sandy loam, moderately deep, 16 to 31 percent slopes, eroded	60	80	65	85	26	4
SmD	Sierra very rocky coarse sandy loam, moderately deep, 9 to 31 percent slopes	60	30	70	90	11	5
SmE	Sierra very rocky coarse sandy loam, moderately deep, 31 to 51 percent slopes	60	30	40	90	6	6
SlD3	Sierra sandy clay loam, 9 to 31 percent slopes, severely eroded	70	80	70	80	31	4
SrE	Sites very rocky loam, 16 to 51 percent slopes	80	30	45	90	10	5
SnB	Sites loam, 3 to 9 percent slopes	90	100	95	90	77	2
SnC	Sites loam, 9 to 16 percent slopes	90	100	80	90	65	2

See footnotes at end of table.

TABLE 3.—*Storie index rating for soils of the Amador Area, Calif.*—Continued

Map symbol	Soil	Factor A (profile)	Factor B (texture)	Factor C (slope)	Factor X (other conditions)	Index rating	Grade
SnD	Sites loam, 16 to 31 percent slopes	90	100	70	90	57	3
SnE	Sites loam, 31 to 51 percent slopes	90	100	40	90	32	4
SrC	Sites very rocky loam, 3 to 16 percent slopes	80	30	80	90	17	5
SrF	Sites very rocky loam, 51 to 85 percent slopes	80	30	20	90	4	6
SoC	Sites loam, moderately deep, 3 to 16 percent slopes	60	100	80	90	43	3
SoD	Sites loam, moderately deep, 16 to 31 percent slopes	60	100	70	90	38	4
SoE	Sites loam, moderately deep, 31 to 51 percent slopes	50	100	40	90	18	5
SpD3	Sites clay loam, moderately deep, 3 to 31 percent slopes, severely eroded	60	85	70	60	21	4
SsE	Sites very rocky loam, moderately deep, 16 to 51 percent slopes	50	30	45	90	6	6
StE	Sites-Mariposa complex, 16 to 51 percent slopes	50	40	45	90	8	6
SwD	Snelling sandy loam, 9 to 16 percent slopes	80	95	85	95	61	2
SwE	Snelling sandy loam, 16 to 31 percent slopes	80	95	70	95	51	3
SvA	Snelling fine sandy loam, 0 to 2 percent slopes	90	100	100	95	86	1
SvB	Snelling fine sandy loam, 2 to 5 percent slopes	90	100	95	95	81	1
SvC	Snelling fine sandy loam, 5 to 9 percent slopes	90	100	90	95	77	2
SuB	Snelling loam, moderately well drained, 0 to 9 percent slopes	90	100	95	80	68	2
SxD	Supan cobbly loam, 3 to 31 percent slopes	75	60	80	100	36	4
SyE	Supan very cobbly loam, moderately deep, 31 to 51 percent slopes	60	30	70	100	13	5
SyD	Supan very cobbly loam, moderately deep, 3 to 31 percent slopes	70	30	70	100	15	5
TcE	Tiger Creek very rocky loam, 16 to 51 percent slopes	70	30	75	100	16	5
WcE	Windy cobbly sandy loam, 16 to 51 percent slopes	75	30	40	100	9	6
WcD	Windy cobbly sandy loam, 9 to 16 percent slopes	75	30	80	100	18	5

[1] Index rating estimated; rating factors not determined.

[2] Variable.

Range Management [2]

About one-half of the Amador Area is used for pasture and range. The acreage is mainly in the western part of the county, but it extends eastward to elevations of about 1,600 to 1,800 feet. At elevations between 1,200 and 1,800 feet there is a gradual transition from grass to timber. Generally, the soils used for pasture and range are too steep, too shallow, or too rocky for cultivated crops. Nevertheless, large acreages suitable for cultivated crops are used for grazing. Also, fairly large areas along stream channels, in parks and meadows, and on shallow, stony ridgetops within timbered areas have value for grazing, and some have been cleared of trees and used to provide forage.

Beef cattle are the main livestock produced. Production of cows and calves and of cattle for stocker and feeder operations is about equal. Minor numbers of dairy animals, sheep, goats, and swine are also produced.

Principles of pasture and range management

Most of the important range forage plants in the Amador Area were introduced. The original forage plants were perennials and annuals, but the introduced plants are mostly annuals. These annuals take full advantage of the moisture that is present, produce seed, and mature by the time the moisture is gone. They furnish highly nutritious feed in spring when they are green and growing, but after maturity their nutritional value is low.

Management of grazing is needed to encourage a desirable mixture of annual plants. Such management must take into account the successive, though overlapping, stages in the growth of annual grasses and forbs; that is, the growth of leaves, growth of roots, formation of flower stalks, and the production of seed. Grazing must be regulated to allow these natural processes to take place. Otherwise, high yields of forage and profitable gains in weight of animals cannot be obtained.

Livestock graze selectively; they seek out the more palatable and nutritious plants. If grazing is not carefully regulated, the better plants are weakened or eliminated. Less desirable plants then increase. If grazing pressure is continued, even the second-choice plants are thinned out or eliminated and undesirable, unpalatable plants take their place or the soil is left bare. Conversely, if grazing land in the Amador Area is too lightly used or left ungrazed for years, ripgut brome and other rank, less desirable plants increase.

Experiences of ranchers and studies by research workers show that if only part of the yearly growth of grass is grazed, damage to the more desirable plants is minimized and the vegetation can reach maximum production. Generally, from 700 to 1,000 pounds per acre of the forage should be left ungrazed on gently sloping to moderately steep soils, and from 1,000 to 1,300 pounds per acre on steep soils and on soils that are highly erodible. The forage left on the surface—

1. Serves as a mulch that encourages rapid intake and storage of water. The more water stored in the soil, the better the growth of plants for grazing.
2. Protects the soil from wind and water erosion.
3. Reduces year to year fluctuation in forage production, because if vigorous, plants make more efficient use of moisture.
4. Holds moisture near the surface after the first rains in fall so that seeds can germinate and get off to an early start.
5. Provides a reserve of feed for years when growing conditions are unfavorable.

[2] By ROCHE D. BUSH, range conservationist, Soil Conservation Service.

Sound range management requires that grazing use be adjusted from season to season, according to the amount of forage produced. Reserve pastures or supplemental feed should be provided during years when growing conditions are unfavorable. Because of habits of growth of annual forage plants, it is not possible to utilize properly all the forage when it is most nutritious. If the forage is used as dry feed in summer or held for early feed in fall, protein supplements are needed for the livestock. Maintaining adequate reserves of feed and forage permits proper use of the vegetation.

Pasture and range sites

Pasture and range sites are kinds of land that produce significantly different kinds or amounts of vegetation. Each site has different potential for production of forage and presents different management problems.

Management practices that will maintain or improve the vegetation are needed on all sites. Practices that are common to all sites are described in the following paragraphs and the effect of weather on forage production is discussed. Then the individual sites are described, the soils in each are listed, and specific practices for that site are given. Production figures given in each site are based on a limited number of clippings, on knowledge of the site, and on estimates; extremes in weather are likely to cause greater fluctuations in production than stated. Some of the soils have not been placed in a site, because they are not suited to that use or are better suited to other uses.

Proper use means grazing in such a way that desirable vegetation is maintained or increased. It also means that enough vegetation is left to protect the soils and reduce erosion. If the vegetation is properly used, it will have a patchy appearance at the end of the growing season. Also, some plants will be untouched or partly grazed, and there will be partly decomposed plant residue on the surface.

Grazing readiness is the time in the growing cycle when there is enough forage to keep livestock healthy. The soils should be dry enough to support livestock without damage to the plants or the soil. Plants reach optimum growth soon after the weather warms and night temperatures are above freezing. A guide for judging grazing readiness is the stage of plant development. Soft chess, wild oats, and other desirable grasses will be 4 to 6 inches high; filaree leaves will have lost their red color and have started to turn up their tips.

Seeding consists of establishing improved perennial or annual grasses and legumes. It helps prevent losses of soil and water. Seeding is done to restore vegetation in poor condition and to establish grass on soils converted from other uses. Seeding is often done on severely deteriorated sites. If annuals are seeded, they should be lightly grazed the first season to insure adequate production of seed. Hardinggrass, other perennial grasses, or legumes, may be seeded in prepared seedbeds where soil characteristics permit. Seeding is feasible on smooth soils that contain few or no stones and that are not too steep for use of machinery, mainly in sites 2, 3, 4, and 6.

Fertilizer is needed to improve forage on large acreages of soils in sites 1, 2, and 3. The response of these soils to fertilizer is best if both nitrogen and phosphate are applied. In some places sulfur stimulates growth of legumes. Applying ammonium phosphate advances the date of grazing readiness, increases total forage, lengthens the growing season, and increases the nutritional value of forage. Areas that are fertilized should be fenced to prevent overgrazing.

Brush control is needed on some sites to improve the vegetation and make handling of livestock easier. Undesirable plants can be controlled on some sites by mechanical or chemical means. Controlled burning can be used on selected sites to remove undesirable kinds of brush.

Other practices that help in managing pasture and range include fencing, salting, and providing water. These practices make it easier to control livestock and to obtain better management.

Adequate fencing is necessary to maintain the quality of livestock and to keep the vegetation in good condition. It enables the operator to move the stock to new pastures so that adequate residues are left on the soil, and thus to promote greater and more uniform production of forage.

Salting can be used to improve the distribution of grazing and to get more uniform use of the vegetation. The salt should always be placed away from water. Livestock will then be drawn into areas that would otherwise be grazed infrequently.

Water should be located at various places so that the vegetation will be grazed evenly. A large number of ponds to provide water for stock have been constructed in the Area, but many more are needed to get full use of the vegetation.

Weather has a greater effect on the production of forage in the Amador Area than any other single factor. This is a direct result of the date of the first significant fall rains, the duration and frequency of subsequent storms, and the temperatures in fall, winter, and spring. For example, year to year fluctuations in production of total forage on the most productive site in the Area may vary from 2,600 pounds per acre in favorable years to as low as 1,500 pounds per acre in less favorable years. Even greater fluctuation occurs because of differences in distribution of rainfall and variations in temperatures. Weather not only affects the production of forage, but it also greatly influences the plant composition. Some years are commonly called "good clover years" or "poor clover years," because of the abundance or lack of burclover on soils where it is suited.

Most of the soils used for pasture and range are shallow, or at best moderately deep, and have moderate to low water-holding capacity. As a rule, annual forage plants are shallow rooted and can fully utilize soil moisture only to the extent of their root system. Therefore, if extended dry periods occur when temperatures are high enough to promote good plant growth, annual forage plants are likely to be damaged by drought. On the other hand, if moderate amounts of moisture fall when favorable growing temperature prevails, yields of forage are good even on the shallow soils.

In the Amador Area, the lowest average annual precipitation is more than 18 inches. During years when rainfall is below normal but the seasonal distribution is good, there is sufficient moisture available for good yields. From 85 to 90 percent of the 18 to 30 inches of average annual precipitation comes during the 6-month period from November 1 to April 30. Therefore, annual forage plants that grow well in cool weather can take advantage of the moisture while it is present.

Following is a discussion of the ten pasture and range sites in the Amador Area.

SITE 1: ROCKY LOAM FOOTHILLS

The soils in this site are in the rolling foothills along a southeast line from Plymouth to Jackson. They are nearly level to steep. Elevations range from 250 to 1,600 feet. On the average, these soils receive from 20 to 30 inches of rain annually. This site consists of about 9,000 acres. The areas are intermingled with those of site 2.

In general, the soils in this site are dark brown to pale brown, variegated somewhat with shades of red, yellow, and gray. They range from fine sandy loams to silty clay loams and are more than 20 inches deep over bedrock. Some of them are rocky or cobbly. These soils are mostly well drained. They have a moderate to high content of organic matter. Most of the soils have moderate to high fertility. Runoff is slow to rapid.

The soils in this site are—

- ArC Auburn silt loam, moderately deep, 3 to 16 percent slopes.
- ArD Auburn silt loam, moderately deep, 16 to 31 percent slopes.
- AtD Auburn very rocky silt loam, moderately deep, 3 to 31 percent slopes.
- AtE Auburn very rocky silt loam, moderately deep, 31 to 51 percent slopes.
- Ho Honcut very fine sandy loam.
- Hs Honcut very fine sandy loam, moderately well drained.
- Hv Honcut very fine sandy loam, channeled.
- Hn Honcut silt loam.
- Hm Honcut clay loam, over clay.
- IdC Inks loam, deep variant, 3 to 16 percent slopes.
- Lo Loamy alluvial land.
- Mo Mixed alluvial land.
- Mp Mixed wet alluvial land.
- Mt Alluvial land; in mapping unit Mt, Mokelumne soils and Alluvial land
- PrA Perkins loam, 0 to 3 percent slopes.
- PrC Perkins loam, 3 to 16 percent slopes.
- RyA Ryer silty clay loam, 0 to 3 percent slopes.
- SxD Supan cobbly loam, 3 to 31 percent slopes.
- SyE Supan very cobbly loam, moderately deep, 31 to 51 percent slopes.
- SyD Supan very cobbly loam, moderately deep, 3 to 31 percent slopes.

These soils are among the best soils for pasture and range in the Area. Vegetation on the steep north-facing slopes is slower in reaching grazing readiness than on the south-facing slopes, but it stays green 10 to 14 days longer. Herbage production on the south-facing slopes differs little from that on the north-facing slopes, but the areas are generally more heavily grazed.

Typically, these soils have a cover of grass or of grass, oak, and digger pine. The herbaceous vegetation is mostly annual grasses and forbs. If the vegetation is producing at maximum, approximately 70 percent of the herbage will be soft chess, wild oats, burclover, filaree, and other desirable plants. It will also include remnants of perennial grasses growing in the open or around and under the blue oaks and interior live oaks. About 20 percent of the vegetation will be ripgut brome, annual fescues, mouse barley, annual lupines, and other less desirable plants. The rest will consist of nitgrass, silver hairgrass, tarweed, popcornflower, turkey mullein, and other undesirable plants. In poor condition, this site will contain some of the less desirable plants, and undesirable plants will be dominant.

On these soils, potential total forage production varies from 2,600 pounds per acre in favorable years to 1,500 pounds per acre in less favorable years.

A satisfactory seedbed can be prepared in many areas in this site, even though some of the soils are very rocky or very cobbly. Where the areas are large enough for pastures, the soils are well suited to Hardinggrass. Once Hardinggrass is established, it begins to put out new shoots soon after the first rain in fall and reaches grazing readiness 3 to 5 weeks before annual plants. It also stays green another 4 to 6 weeks after the annuals have matured and dried up. Areas seeded to Hardinggrass should be fenced separately to help control grazing. Where only a partial seedbed can be prepared, the soils are well suited to Lana vetch, rose clover, or subterranean clover planted in combination with Blando brome.

Forage plants on this site respond if fertilizer that contains ammonium phosphate is applied. For full response, adequate amounts should be applied the first year. Yearly followup applications can be reduced about half. In this way, usable forage production can be increased to as much as 6,800 pounds. The fertilizer should be applied before the first rains in fall. Fencing is essential for proper use in fertilized and unfertilized areas.

Thickets of oak can economically produce much more usable forage if the oak is removed for wood or charcoal or if standing trees are killed with chemicals. Soils that have slopes of 31 to 51 percent should be avoided when areas are selected for clearing. Once the trees are killed or removed, the forage plants increase and are also more palatable to livestock. Generally, no seeding is necessary unless the thickets are so dense that grasses and forbs are excluded from the understory. A good followup program is necessary to control regrowth on treated areas, particularly if live oaks are in the stand.

Soils in this site that are not rocky or very cobbly should be the first considered for improvement through seeding, fertilizing, or brush control.

SITE 2: SHALLOW ROCKY LOAM FOOTHILLS

The soils in this site are in the rolling foothills along a southwest line from Plymouth toward Ione. They are gently sloping to steep. Elevations range from 250 to 1,600 feet. The average annual rainfall ranges from 20 to 30 inches. This site consists of about 48,500 acres; the areas are intermingled with those of site 1.

The soils in this site are reddish-brown, brown, and yellowish-red loams and silt loams that are shallow over bedrock. These soils are well drained to moderately well drained. They have low to moderate water-holding capacity and very slow to moderate permeability. Their content of organic matter is moderate. Runoff is slow to very rapid.

The soils in this site are—

- AnD Argonaut gravelly loam, 3 to 31 percent slopes.
- AoD Argonaut very rocky loam, 3 to 31 percent slopes.
- ApD Auburn silt loam, 0 to 31 percent slopes.
- AsB2 Auburn very rocky silt loam, 3 to 9 percent slopes, eroded.
- AsD Auburn very rocky silt loam, 3 to 31 percent slopes.
- AsE Auburn very rocky silt loam, 31 to 51 percent slopes.
- AwC Auburn silt loam, 0 to 16 percent slopes; Argonaut silt loam, 0 to 16 percent slopes; in mapping unit AwC Auburn-Argonaut silt loams, 0 to 16 percent slopes.
- AxD Auburn very rocky silt loam, 3 to 31 percent slopes; Argonaut very rocky silt loam, 3 to 31 percent slopes; in mapping unit AxD, Auburn-Argonaut very rocky silt loams, 3 to 31 percent slopes.

EhD Exchequer loam, 3 to 31 percent slopes; Auburn loam, 3 to 31 percent slopes; in mapping unit EhD, Exchequer and Auburn loams, 3 to 31 percent slopes.

ExD Auburn very rocky loam, 3 to 31 percent slopes; in mapping unit ExD, Exchequer and Auburn very rocky loams, 3 to 31 percent slopes.

ExE Auburn very rocky loam, 31 to 51 percent slopes; in mapping unit ExE, Exchequer and Auburn very rocky loams, 31 to 51 percent slopes.

This is the most extensive range and pasture site in the Area. On the steep, north-facing slopes, vegetation is slower in reaching grazing readiness than on the south-facing slopes, but it stays green 10 to 14 days longer. Herbage production on the south-facing slopes differs little from that on the north-facing slopes, but the south slopes are generally more heavily grazed.

Typically, these soils have a cover of grass or of grass, oak, and digger pine (fig. 12). In places there are dense stands of oaks. The forage is mostly annual grasses and forbs. If the vegetation is producing at maximum, approximately 70 percent of the herbage will be soft chess, wild oats, burclover, filaree, and other desirable plants. It will also include remnants of perennial grasses growing in the open or under the blue oaks and interior live oaks. Approximately 20 percent of the vegetation will be ripgut brome, annual fescues, mouse barley, annual lupines, and other less desirable plants. The rest will consist of nitgrass, silver hairgrass, tarweed, popcornflower, turkey mullein, and other undesirable plants. In poor condition, range on this site will contain some of the less desirable plants, and undesirable plants will be dominant.

Potential total forage production per acre varies from 2,200 pounds in favorable years to 1,300 pounds in less favorable years.

An adequate seedbed can be prepared in most places, even though in some places the soils are very rocky and very stony. The soils are suited to annual grasses, such as Blando brome, and to such legumes as Lana vetch, subterranean clover, and rose clover. Areas that are seeded

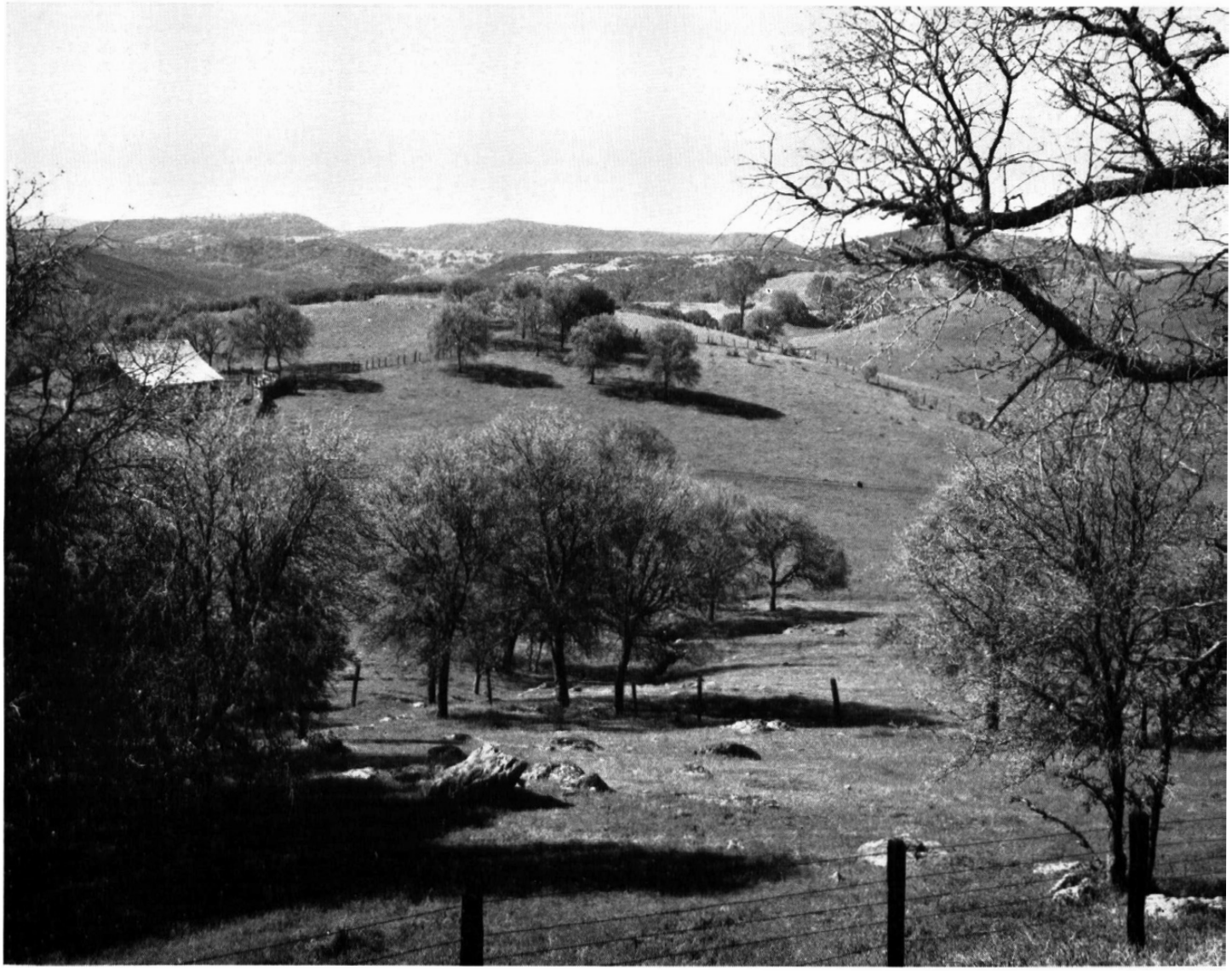

Figure 12.—**Typical vegetation in site 2; an Auburn very rocky silt loam is in the foreground.**

should be protected from grazing the first year until after the plants mature and produce seed, but special fencing is not necessary.

Forage plants on this site respond if fertilizer that contains ammonium phosphate is applied. For full response, adequate amounts should be applied the first year. Yearly followup applications can be reduced to about half. In this way, forage production can be increased to as much as 6,800 pounds. The fertilizer should be applied prior to the first rains in fall. For proper use of the range, fertilized and unfertilized areas should be fenced separately.

Thickets of oak can economically produce much more forage if the oak is removed for wood or charcoal or if standing trees are killed with chemicals. Soils that have slopes of 31 to 51 percent should be avoided when areas are selected for clearing. Once the trees are killed or removed, the forage plants increase and are also more palatable to livestock. Generally, no seeding is necessary unless the thickets are so dense that grasses and forbs are excluded from the understory. A good followup program is necessary to control regrowth on treated areas, particularly if live oak is in the stand.

SITE 3: DEEP GRANITIC SOILS

The soils in this site are partly on granitic foothills east and northeast of the town of Plymouth and partly on granitic terraces in the southwest corner of the Area. They are rolling to very steep, but the slope is mostly 16 to 51 percent. Elevations range from 800 to 1,600 feet. On the average, these soils receive from 25 to 30 inches of rainfall annually. About 7,300 acres are in this site.

In general, the soils in this site are brown, yellowish red, or grayish brown. The texture of the surface soil ranges from loam to coarse sandy loam. These soils are generally more than 20 inches deep over granitic bedrock or weakly consolidated granitic alluvium. Their content of organic matter is moderate to moderately low. Runoff is slow to rapid, and the soils are subject to erosion. The soils are mostly well drained and have moderate to high water-holding capacity. Permeability is mostly moderate to moderately rapid in the surface soil and moderate to moderately slow in the subsoil. The Shenandoah soil and Snelling loam, moderately well drained, 0 to 9 percent slopes, however, are moderately well drained to imperfectly drained; permeability of the subsoil is moderately slow to very slow.

The soils in this site are—

AaB	Ahwahnee loam, 3 to 9 percent slopes.
AaB2	Ahwahnee loam, 3 to 9 percent slopes, eroded.
AaC	Ahwahnee loam, 9 to 16 percent slopes.
AaC2	Ahwahnee loam, 9 to 16 percent slopes, eroded.
AaD	Ahwahnee loam, 16 to 31 percent slopes.
AaD2	Ahwahnee loam, 16 to 31 percent slopes, eroded.
AdD	Ahwahnee very rocky loam, 9 to 31 percent slopes.
AdD3	Ahwahnee very rocky loam, 16 to 31 percent slopes, severely eroded.
AdE	Ahwahnee very rocky loam, 31 to 51 percent slopes.
SfB	Shenandoah loam, 3 to 9 percent slopes.
SgB	Sierra coarse sandy loam, 3 to 9 percent slopes.
SgB2	Sierra coarse sandy loam, 3 to 9 percent slopes, eroded.
SgC	Sierra coarse sandy loam, 9 to 16 percent slopes.
SgC2	Sierra coarse sandy loam, 9 to 16 percent slopes, eroded.
SgD	Sierra coarse sandy loam, 16 to 31 percent slopes.
SgD2	Sierra coarse sandy loam, 16 to 31 percent slopes, eroded.
SkD	Sierra very rocky coarse sandy loam, 16 to 31 percent slopes.
SkF	Sierra very rocky coarse sandy loam, 51 to 71 percent slopes.
ShB	Sierra coarse sandy loam, moderately deep, 3 to 9 percent slopes.
ShB2	Sierra coarse sandy loam, moderately deep, 3 to 9 percent slopes, eroded.
ShC	Sierra coarse sandy loam, moderately deep, 9 to 16 percent slopes.
ShC2	Sierra coarse sandy loam, moderately deep, 9 to 16 percent slopes, eroded.
ShD	Sierra coarse sandy loam, moderately deep, 16 to 31 percent slopes.
ShD2	Sierra coarse sandy loam, moderately deep, 16 to 31 percent slopes, eroded.
SmD	Sierra very rocky coarse sandy loam, moderately deep, 9 to 31 percent slopes.
SmE	Sierra very rocky coarse sandy loam, moderately deep, 31 to 51 percent slopes.
SlD3	Sierra sandy clay loam, 9 to 31 percent slopes, severely eroded.
SvA	Snelling fine sandy loam, 0 to 2 percent slopes.
SvB	Snelling fine sandy loam, 2 to 5 percent slopes.
SvC	Snelling fine sandy loam, 5 to 9 percent slopes.
SwD	Snelling sandy loam, 9 to 16 percent slopes.
SwE	Snelling sandy loam, 16 to 31 percent slopes.
SuB	Snelling loam, moderately well drained, 0 to 9 percent slopes.

On the steep north-facing slopes, the vegetation is slower in reaching grazing readiness than on the south-facing slopes, but it stays green 10 to 14 days longer. Herbage production on the south-facing slopes differs little from that on the north-facing slopes, but the areas are generally more heavily grazed.

Typically, vegetation on these soils consists of grass, oak, and ponderosa pine. The areas infringe on the lower edges of pine-timbered tracts and in places on the north slopes there are scattered pines and associated browse plants or pockets of pines. The forage is largely made up of annual grasses and forbs, but some small areas support fair stands of native perennial grasses. If the vegetation is producing at maximum, about 70 percent of the herbage will be a mixture of soft chess, wild oats, filaree, small amounts of burclover, and other desirable plants. It will also include remnants of blue wildrye, creeping wildrye, dryland sedges, and other perennials in places on the north-facing slopes. Approximately 20 percent of the vegetation will be ripgut brome, annual fescues, mouse barley, annual forbs, and other less desirable plants. The rest will consist of fiddleneck, tarweed, Klamath weed, dogtail, nitgrass, turkey mullein, and other undesirable plants. In poor condition, this site will contain some of the less desirable plants, but undesirable plants will be dominant.

On the gently sloping to moderately steep soils, potential total forage production ranges from 2,200 pounds per acre in favorable years to 1,300 pounds per acre in less favorable years.

A satisfactory seedbed can be prepared in many areas, even though some of these soils are very rocky or steep. The areas are large enough for pastures, and the soils are suited to perennial grasses, particularly the Sierra soils which are well suited to Hardinggrass. If Hardinggrass is established, the area should be fenced so that grazing can be controlled.

Forage plants on this site respond if ammonium phosphate fertilizer is applied. For full response adequate amounts should be applied the first year. Yearly follow-up applications can be reduced to about half. In this way, forage production can be increased to as much as 6,800 pounds. Fencing is essential in fertilized and un-

fertilized areas. Legumes on this site respond if sulfur is applied.

Soils that have thickets of oak or brush can economically produce more usable forage if the oak is removed for firewood or charcoal or if standing trees are killed with chemicals. Soils that have slopes of 31 to 71 percent should be avoided when areas are selected for clearing. Once the trees are killed or removed, the forage plants increase and are also more palatable to livestock. Generally, seeding is not necessary, unless the thickets are so dense that grasses and forbs are excluded from the understory. A good program is needed to control regrowth on treated areas, particularly if live oak is in the stand.

Soils in this site that have slopes of 0 to 16 percent should be the first considered for improvement through seeding, fertilizing, or brush control.

SITE 4: UPLAND TERRACES

The soils in this site occupy narrow areas on terraces along a northwest-southeast line in the southwestern part of the Area. They are mostly nearly level to rolling, but they are somewhat steeper in places. Elevations range from 200 to 600 feet. The average annual rainfall ranges from 18 to 24 inches. This site consists of about 6,000 acres. The areas are intermingled with those of site 6.

Characteristically, the soils in this site are brown, reddish-brown, and grayish-brown cobbly gravelly loams, coarse sandy loams, and sandy loams. These soils are shallow to moderately deep over gravelly alluvium, sandstone, clay, or consolidated volcanic tuff and conglomerate. They have moderate to low water-holding capacity. Permeability is mostly moderate, but it is slow in the Peters soil. These soils are medium acid to very strongly acid. Their content of organic matter is moderate. Fertility is low to very low, and runoff is slow to very rapid.

The soils in this site are—

- Ma Made land.
- MrB Mokelumne sandy loam, 2 to 5 percent slopes.
- MsD Mokelumne coarse sandy loam, 5 to 36 percent slopes.
- Mt Mokelumne sandy loam, 2 to 5 percent slopes; in mapping unit Mt, Mokelumne soils and Alluvial land.
- PaD Pardee cobbly loam, 3 to 31 percent slopes.
- PtB Peters clay, 3 to 9 percent slopes.
- RbB Red Bluff gravelly loam, 0 to 5 percent slopes; Mokelumne gravelly sandy loam, 0 to 5 percent slopes; in mapping unit RbB, Red Bluff-Mokelumne complex, 0 to 5 percent slopes.
- RbD Red Bluff gravelly loam, 5 to 16 percent slopes; Mokelumne gravelly loam, 5 to 16 percent slopes; in mapping unit RbD, Red Bluff-Mokelumne complex, 5 to 16 percent slopes.
- RbE2 Red Bluff gravelly loam, 16 to 36 percent slope, eroded; Mokelumne gravelly sandy loam, 16 to 36 percent slopes, eroded; in mapping unit RbE2, Red Bluff-Mokelumne complex, 16 to 36 percent slopes, eroded.
- RmD Red Bluff gravelly loam, 2 to 16 percent slopes; Mokelumne gravelly sandy loam, 2 to 16 percent slopes; in mapping unit RmD, Red Bluff-Mokelumne-Mine pits complex, 2 to 16 percent slopes.

These soils are among the least productive soils for pasture and range in the Area. The vegetation on these soils is typically oak-grass; live oak and blue oak make up about equal parts of the woody canopy. On large acreages the stands of oak are dense and hinder the growth of forage, grasses, and forbs. If the vegetation is producing at maximum, about 70 percent of the herbage will be a mixture of soft chess, small annual clovers, filaree, and other desirable plants growing between and under the oaks; there will be little or no burclover. Approximately 20 percent of the vegetation in the understory will be ripgut brome, annual fescues, annual lupine, buttercup, annual geranium, and other less desirable plants. The rest will consist of nitgrass, dogtail, silver hairgrass, goldfields, owls-clover, and tarweed. In poor condition, this site will contain some of the less desirable plants, but undesirable plants will be dominant.

Potential total forage production varies from 1,500 pounds per acre in favorable years to 900 pounds per acre in less favorable years.

It is difficult to prepare a satisfactory seedbed in soils of this site, even though the soils are mostly rock free and have gentle slopes. Nearness of bedrock to the surface, low fertility, and tightness of the subsoil make the soils unsuitable for seeding to grasses and legumes. Lana vetch, subterranean clover, rose clover, and Blando brome are best suited for reseeding. If a seedbed is prepared, shallow tillage should be used to keep from mixing strongly acid material from the subsoil with the surface soil.

Forage plants on soils in this site respond if large amounts of ammonium phosphate are applied. The increase in yields, however, probably would not justify the cost. Plants give little or no response if lime is applied.

Brush and dense stands of oak are common on large acreages in this site. Yields of usable forage can be increased if the oak is removed for firewood or charcoal, or if standing trees are killed with chemicals. A good program is needed to control regrowth on treated areas.

Soils in this site that are suitable for cultivation should be the first considered for improvement.

SITE 5: EXTREMELY ROCKY LAND

This site is in foothills mostly within a triangular area marked by the towns of Plymouth, Jackson, and Ione. A small acreage of granitic soils is in the vicinity of Shenandoah Valley. The soils in this site are in small areas, generally on ridgetops, and are gently rolling to very steep. Elevations range from 500 to 1,600 feet. These soils receive 24 to 30 inches of rainfall annually. This site consists of about 3,200 acres, and the areas are scattered throughout sites 1 and 2.

In general, the soils in this site are brown and reddish-brown extremely rocky silt loams and loams that are 10 to 36 inches deep over bedrock. These soils are well drained and have low to moderate water-holding capacity. Permeability is moderate to moderately slow. The content of organic matter is moderate, and runoff is medium to very rapid.

The soils in this site are—

- AfD Ahwahnee extremely rocky loam, 9 to 51 percent slopes.
- AuD Auburn extremely rocky silt loam, 3 to 31 percent slopes.
- AuF Auburn extremely rocky silt loam, 31 to 71 percent slopes.
- AvE Auburn extremely rocky silt loam, moderately deep, 31 to 71 percent slopes.

Typically, vegetation on these soils consists of grass-oak or grass, oak, and digger pine. In a large acreage the understory in wooded areas consists of dense stands of brush that hinder growth and lower the yields of annual grasses, forbs, and other herbaceous vegetation in the understory. If the vegetation is producing at maximum, about 70 percent of the herbage will be soft chess, wild

oats, burclover, filaree, and other desirable plants. It will also include remnants of perennial grasses growing among the rocks, in the open, or around and under the blue oaks and interior live oaks. Approximately 20 percent of the vegetation will be ripgut brome, annual fescues, mouse barley, annual lupines, and other less desirable plants. The rest will consist of nitgrass, silver hairgrass, tarweed, popcornflower, turkey mullein, and other undesirable plants. In poor condition, this site will contain some of the less desirable plants and undesirable plants will be dominant.

Potential total forage production varies from 1,200 pounds per acre in favorable years to 700 pounds per acre in less favorable years. Yields vary, depending on the amount of rock outcrops on the surface.

This site is too rocky for reseeding, except for emergency erosion control.

The grass best suited for erosion control is Blando brome.

Applying fertilizer to soils in this site is not feasible.

Because of the rock outcrop, the soils in this site should not be considered for clearing. Areas that are in brush and trees provide a good habitat for valley quail and good shade for livestock.

SITE 6: SANDY LOAM FOOTHILLS

The soils in this site are in the southwestern part of the Area. They are mostly gently sloping and rolling and on foothills, but a few areas are somewhat steeper and on ridges. In most places elevations are from 200 to 600 feet, but a small acreage is at slightly higher elevations. This site receives an average of 18 to 24 inches of rainfall annually: About 6,000 acres are in this site, and the areas are intermingled with those of sites 4 and 8.

Most of the soils in this site are light brownish-gray or pale-brown to reddish-brown sandy loams and gravelly sandy loams that are generally less than 20 inches deep over rhyolitic tuff. These soils are mostly well drained to somewhat excessively drained and have low water-holding capacity. Permeability is moderately rapid to rapid. These soils are slightly acid to strongly acid. Their content of organic matter is moderate. Runoff is slow to very rapid. The soils are droughty, and if they are not protected, the erosion hazard is moderate to severe.

The soils in this site are—

- AeE Ahwahnee very rocky loam, shallow, 16 to 51 percent slopes.
- LgB Laniger sandy loam, thick surface, 0 to 5 percent slopes.
- LaC Laniger sandy loam, 2 to 16 percent slopes.
- PnC Pentz sandy loam, 2 to 16 percent slopes.
- PnC2 Pentz sandy loam, 9 to 16 percent slopes, eroded.
- PnD Pentz sandy loam, 16 to 31 percent slopes.
- PpC Pentz gravelly sandy loam, 2 to 16 percent slopes.

Typically, vegetation on these soils consists of open grassland with scattered blue oaks and a few oak thickets. The forage is mostly annual grasses and forbs. If the vegetation is producing at maximum, about 70 percent of the herbage will be soft chess, annual clovers, filaree, small amounts of wild oats, and other desirable plants. There will be little or no burclover present. Approximately 20 percent of the vegetation will be ripgut brome, annual fescues, annual lupines, and other less desirable plants. The rest will consist of nitgrass, dogtail, silver hairgrass, tarweed, popcornflower, and other undesirable plants. In poor condition, this site will contain some of the less desirable plants, but undesirable plants will be dominant.

Potential total forage production varies from 1,900 pounds per acre in favorable years to 1,100 pounds per acre in less favorable years.

A satisfactory seedbed is difficult to prepare in soils of this site. Because of the low water-holding capacity, seeding grasses and legumes is a risk. Lana vetch and Blando brome are best suited for reseeding.

Forage plants on soils in this site respond well if fertilizer is added. The use of fertilizer is probably not economically feasible on these droughty soils.

Brush is generally not a problem on this site. Yields of forage could be increased in dense stands of blue oak, if the oak were removed for firewood or if standing trees were killed with chemicals. A good program is needed to control regrowth on treated areas.

Soils in this site that are suitable for cultivation should be the first considered for improvement.

SITE 7: ROUGH SERPENTINE LAND

Only one soil is in this site. It is gently sloping to steep. The areas are generally on ridgetops and side slopes. They are narrow and lie in a northwest-southeast direction across the Area about 3 miles east of Ione. Elevations range from 500 to 1,500 feet. This site receives an average of 24 to 30 inches of rainfall annually. About 2,000 acres are in this site.

The soil in this site is dark reddish-brown loam or silt loam and is very shallow over serpentine bedrock. This soil has very low water-holding capacity and fertility. Permeability is moderate, the content of organic matter is moderate to low, and runoff is medium to very rapid.

The soil in this site is—

- HaD Henneke very rocky loam, 3 to 51 percent slopes.

This soil is one of the poorest for grazing in the Area. Typically, the vegetation on this soil consists of brush or of brush and grass. Chamise, yerba santa, toyon, and deerbrush are the predominant brush plants. If the vegetation is producing at maximum, about 50 percent of the herbage will be a mixture of soft chess, filaree, and other desirable plants. It will also include remnants of needlegrass and squirreltail growing around and under the brush. There will be little or no burclover. Approximately 35 percent of the understory will be red brome, mouse barley, annual lupines, large amounts of annual fescues, and other less desirable plants. The rest will be owls-clover, gold-fields, brodiaea, popcornflower, vinegarweed, and other undesirable plants. In poor condition, vegetation on this site will contain some of the less desirable species, but undesirable plants will be dominant.

Potential total forage production varies from 1,200 pounds per acre in favorable years to only limited grazing in unfavorable years.

The soils in this site are not suitable for reseeding, except for emergency erosion control. Blando brome is the most suitable grass for erosion control. Applying fertilizer to soils in this site is not feasible.

Much of this site is in brush, but the soils are so shallow, rocky, and low in fertility that the expense of clearing them would not be justified.

SITE 8: VERY SHALLOW VOLCANIC LAND

The soils in this site are gently sloping to moderately steep and are interspersed with ridges that have flat tops and fairly steep side slopes. The areas are in the southwestern part of the Area along the county line. In most places the slope is less than 30 percent. Elevations range from 250 to 600 feet. The average annual precipitation is about 18 to 24 inches. About 9,500 acres are in this site.

In this site the soils are pale-brown, dark-brown, and dark grayish-brown loams and sandy loams that are generally less than 10 inches deep over rhyolitic tuff. These soils adjoin areas of undifferentiated, dark-brown, medium-textured cobbly soils and andesitic rock land. The areas of andesitic rock land are barren and interspersed with hummocky areas of cobbly soil that is 10 to 15 inches deep. All of the soils have very low water-holding capacity, and annual vegetation on them dries up early in spring or during extended periods of drought in winter. The content of organic matter is moderate. Runoff is medium to very rapid.

The soils in this site are—

- IrE Inks loam, 3 to 45 percent slopes; in mapping unit IrE, Inks loam and Rock land, 3 to 45 percent slopes.
- IsE Iron Mountain very stony loam, 9 to 51 percent slopes.
- PoE Pentz sandy loam, very shallow, 2 to 51 percent slopes.

The soils in this site are among those that have the lowest production for pasture and range in the Area. Typically, the vegetation on these soils consists of grass and of a few scattered blue oaks. The forage is mostly annual grasses and forbs. If the vegetation is producing at maximum, about 70 percent of the herbage will be soft chess, filaree, annual clovers, and other desirable plants. On the medium-textured soils on hummocks, it will also include burclover and wild oats. Approximately 20 percent of the vegetation will be red brome, mouse barley, annual lupines, annual fescue, and other less desirable plants. The rest will be nitgrass, silver hairgrass, owlsclover, gold-fields, popcornflower, and other undesirable plants. In poor condition, vegetation on this site will contain some less desirable plants, and undesirable plants will be dominant.

Potential total forage production varies from 1,400 pounds per acre in favorable years to limited or no grazing in unfavorable years.

The soils in this site are not suitable for reseeding, except for emergency erosion control. Blando bromegrass is the best suited for erosion control. Applying fertilizer to soils in this site is not feasible. Brush is not a problem.

SITE 9: VERY SHALLOW LAND

The soils in this site are gently rolling to steep. They are in narrow areas that reach northwest from Pardee Reservoir to just east of Ione. The slope ranges from 3 to 51 percent, but it is mostly more than 16 percent. Elevations range from 500 to 1,200 feet. On the average, annual precipitation is 22 to 28 inches. About 18,500 acres are in this site.

In this site the soils are generally brown or yellowish-brown loams or silt loams that are less than 10 inches deep to metasedimentary slate and schist or metabasic rock. These soils are somewhat excessively drained. They have very low water-holding capacity, and vegetation on them dries early in spring or during periods of extended drought in winter. The content of organic matter is moderate. Runoff is medium to very rapid.

The soils in this site are—

- EcD Exchequer very rocky silt loam, 3 to 31 percent slopes.
- EcE Exchequer very rocky silt loam, 31 to 51 percent slopes.
- ExD Exchequer very rocky loam, 3 to 31 percent slopes; in mapping unit ExD, Exchequer and Auburn very rocky loams, 3 to 31 percent slopes.
- ExE Exchequer very rocky loam, 31 to 51 percent slopes; in mapping unit ExE, Exchequer and Auburn very rocky loams, 31 to 51 percent slopes.

These soils are among the most bushy and least productive soils in the Area. Typically, vegetation on these soils consists of dense stands of brush and occasional open areas of grass and of grass and brush. Digger pines and blue oaks are scattered over the site. The predominant brush plants are chamise, scrub oak, manzanita, deerbrush, yerba santa, and poison-oak. If the vegetation is producing at maximum, approximately 70 percent of the herbage will be soft chess, filaree, and other desirable plants. It will also include wild oats and burclover in places where the soil is slightly deeper. About 20 percent of the vegetation will be red brome, mouse barley, annual lupines, annual fescues, and other less desirable plants. The rest will consist of nitgrass, silver hairgrass, owlsclover, gold-fields, popcornflower, and other undesirable plants. In poor condition, vegetation on this site will be dominantly brush, and grass will be sparse in the understory.

Total forage production in open areas varies from 1,300 pounds per acre in favorable years to limited or no grazing in unfavorable years.

The soils in this site are not suitable for reseeding, except for emergency erosion control. Blando brome is the best suited grass for erosion control. Applying fertilizer to the soils in this site is not feasible.

Stands of brush are dense on these soils. Generally it would not pay to remove the brush and attempt to control regrowth. In some places, however, clearing of these areas might be justified to make more accessible other areas that are better suited to grazing.

SITE 10: PLACER DIGGINGS AND RIVERWASH

Only one land type is in this site. It consists of variable soil material in stream channels and swales. The areas are long and narrow, and most of them are small. They are near, and in many places within, areas of cobbly riverwash and mine tailings. The slope is mostly less than 9 percent. About 5,000 acres are in this unit.

The soil material in this site consists of debris left by placer mining. As a result, the material is a mixture of various soil materials and the surface is scarred and uneven. All areas contain fine soil material suitable for varying amounts of forage. The soil material is shallow to deep and in many places is underlain by coarse sand or gravel. Drainage and permeability vary. Areas in streambeds are subject to flooding in winter.

The land type in this site is—

- Pw Placer diggings and Riverwash.

Vegetation on this site varies. Many areas support a dense stand of trees and brush with an understory of annual and perennial forbs and grasses. On some areas annual grasses and forbs are dominant. The main trees and brush plants are willow, alder, cottonwood, blackberry, wild rose, poison-oak, live oak, and white oak,

which generally do not add much to the usable forage. Desirable grasses and forbs, which furnish most of the forage on this site, are bluegrass, blue wildrye, mountain brome, sedges, soft chess, annual clovers, and filaree. Stinging nettle, horehound, wormwood, deergrass, wiregrass, and other undesirable plants are also present.

Total forage production varies from as much as 2,000 pounds per acre to almost nothing, depending on the soil material; it varies greatly within short distances.

Enough plants should be left in the understory on this site to protect the soil from erosion. The size and importance of a particular area in relation to other sites with which it is being used should be considered in determining needed practices and proper use.

Stock should be kept off this site until such desirable grasses as blue wildrye and mountain brome are 6 to 8 inches high. Grazing readiness also depends on the adjoining sites with which this site is used.

Areas of this site are generally too narrow and the soil material too variable for reseeding. Yields would not justify the cost of fencing and other management. Furthermore, because of annual flooding, the erosion hazard is severe if the areas are left unprotected in winter. Applying fertilizer on this site is not feasible.

In small areas dense stands of trees and brush could probably be thinned and use of the site improved. The expense of clearing areas for increased yields alone would not be justified, because intensive practices that prevent regrowth of brush are required.

Woodland Uses of the Soils[3]

Woodland in the Amador Area provides products for sale or for use on the farm. It also protects the watersheds that supply water to several large communities in the eastern San Francisco Bay area, is an important source of forage for livestock, and provides food and cover for deer and many other kinds of wildlife. In addition, the woodland provides vacation areas for residents and attracts tourists.

Trees cut from the woodland supply timber to four sawmills in the county and to many others nearby. Some of the products are lumber, poles, piling, firewood, pulp chips, pencil stock, and fenceposts. Ponderosa pine, Jeffrey pine, sugar pine, Douglas-fir, red fir, and incense-cedar are the main trees cut for lumber.

The soils suited to coniferous trees cover about 41 percent of the total Area, or about 124,000 acres. In about 70,000 acres the canopy contains at least 10 percent of coniferous trees. Originally, extensive stands of coniferous trees grew at elevations of as low as 1,000 feet (*10*). Where soil conditions were favorable, strips and islands of conifers probably extended almost to the floor of the Great Valley; a remnant of one of these is near Ione. On the other hand, vegetation of oak and grass extends into the mountainous uplands to elevations of more than 3,000 feet where the soil and climate are favorable.

Ponderosa pine and black oak are the most common trees in the woodland. These trees grow throughout the Area in pure stands or mixed stands of various densities. Red alder also grows throughout the Area along streams. Valley oak, Oregon ash, black willow, and Fremont cottonwood also grow along streams and in low places in the western part of the Area. Blue oak, interior live oak, a few MacNab cypress, and the rare oracle oak grow in the lower foothills; in many places they grow in association with digger pine. Stands of blue oak and digger pine extend into the higher foothills where the soil and climate are favorable. Incense-cedar generally grows at high elevations and in some places the stands are dense, but these trees also grow in cool canyons at low elevations.

Sugar pine and Douglas-fir are at elevations of about 2,000 feet and eastward. A little further east are stands of white fir. Here black cottonwood grows along stream bottoms. There are also small areas of California-nutmeg, and in cool areas, Pacific yew. In some places there are dense stands of knobcone pine. Red fir, lodgepole pine, Jeffrey pine, and aspen are at elevations of more than 5,000 feet.

The trees in the original forests were of about the same species as those in the present woodland, but then the trees were mainly high quality old growth and the stands were open and free of brush. Little use was made of the forests until gold was discovered in 1848 and large numbers of people came to the Area. For several years after that, much timber was cut to supply the needs of the mining industry, to provide lumber for homes, and to use as firewood. Only the best trees were cut, and of these only knot-free logs were used (*12*). Forest fires many times burned unchecked.

Mining declined and land was cleared for agriculture; but agriculture also declined and some areas were then abandoned. Conifers restocked naturally on the cleared land in places, but much of the cleared land reverted to brush. Grazing by cattle increased, particularly at lower elevations. Cattlemen burned the areas periodically to eliminate brush, and thus prevented natural restocking of conifers.

Logging and clearing for agriculture increased during and immediately after World War I, and the mining industry expanded in the 1930's; but these activities had little effect on the general trend. During World War II, however, second-growth stands were cut for lumber, poles, piling, and pulp, and the use of wood for fuel declined. Much land was cleared or recleared for agriculture. Grazing increased and the practice of burning for brush control also increased. Measures for the control of fires were started by governmental agencies, but wildfire remained a problem. Consequently, a deforested belt of land resulted. In these places relict pines, such as those near Ione, and remnants of stands of black oak on soils that support conifers mark the site of former forests. In other places the site of former forests is indicated only by characteristics of the soils.

Management of woodland

The primary purposes of woodland management are (1) to protect the trees, the soils, and adjacent areas, and particularly areas downstream, from runoff and erosion; (2) to obtain maximum yields of high-quality wood products at the least cost, and (3) to provide areas for recreation and for food and cover for wildlife.

Woodlands can be maintained and improved by protecting the areas from fire and erosion, from overgrazing by livestock, and from damage by insects and diseases

[3] By MILTON B. EDWARDS, woodland conservationist, Soil Conservation Service.

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Other practices of value are thinning, weeding, and pruning the trees, harvesting the trees so as to provide for natural regeneration of the stand, and seeding the areas or planting young trees.

Protecting the trees from fire is the most important practice in management of woodland. Fire can wipe out a wood crop in a few minutes. It destroys forest litter and exposes the soil to the weather. As a result, runoff is increased and causes serious erosion to the soils and flooding in the streams below. Fire has probably caused serious erosion on a greater acreage in California than all other agents combined. Even a light fire destroys protective litter; kills young trees; scars the roots of older trees, weakens them, and opens the way for insects and diseases. Practices that help protect the areas from fire are constructing firebreaks, preventing the accumulation of large amounts of slash and trash, providing for storage of water at strategic locations, and keeping fire fighting tools and equipment readily accessible for use when needed (fig. 13).

***Figure 13.*—Pruning and disposal of slash help protect woodland from fire.**

Roads, skid trails, and landings should be located, if feasible, on the less erodible soils. They should be above stream channels and graded properly, and suitable culverts and bridges should be constructed. Secondary roads should be slightly outsloped. Mulching is needed on areas that are likely to erode after use, and cross ditches are needed in some places.

In many places the trees can be protected from insects if trees that are susceptible are removed. Trees that are already infested can be treated by cutting out the part infested, by spraying or by burning, or by removal of the entire tree.

Protection from disease can also be attained in places through harvesting trees that are susceptible, but specific treatment for the specific disease is sometimes necessary.

Livestock, deer, bears, rabbits, porcupines, mice, squirrels, and beavers are all likely to cause damage to trees. Damage by animals can be controlled if animal populations are kept at or below the number that can be supported by the forage available. Reducing the numbers of some wild animals is restricted, however, by game laws.

Improvement cuttings are generally feasible if the sale of wood brings a return at least equal to the cost of the cutting. The poorest and least valuable trees should be removed and the faster growing, better trees left. Only those trees that will add several inches of clear wood by the time they are harvested should be pruned.

Harvest cuttings are made in several ways, including clear cutting. Harvesting should be done so that a new stand is regenerated naturally or by planting, either before or immediately after the cutting. If this is not done, the soils are likely to be severely eroded, and brush will quickly encroach on the areas.

The success of tree planting varies. If brush has been completely removed, planting is generally successful. On soils that are steep, however, or subject to erosion, the hazard of erosion is severe if the brush is removed. In these places bulldozing of brush should be on the contour. Ponderosa pine is most commonly planted in the Amador Area, but little direct seeding of ponderosa pine has been done.

Woodland suitability groups

To assist owners of woodland in planning the use of their soils many of the soils have been placed in woodland suitability groups. Each group is made up of soils that have similar characteristics, respond to similar management, and have like hazards for the production of wood crops. For each group, ratings are given according to similarities of site quality, hazard of erosion, limitations to use of equipment, insect and disease hazards, windthrow hazard, and response to management. These are discussed in the paragraphs that follow. Then each woodland suitability group is described, the soils in each group are listed, and factors that affect management of each group are discussed. Some of the soils have not been placed in a woodland suitability group, because they are not suited to that use or are better suited to other uses.

Site quality is the measure of the productivity of the soil for growing trees. In this report it refers to site quality for ponderosa pine; but, studies show that associated conifers on similar sites have about the same relationship in height and age as ponderosa pine (*10*). Site index for ponderosa pine is based on the height attained by the average dominant and codominant trees in the stand at 100 years of age (*17*). The ratings used for site quality are *high*, *medium*, and *low*. The rating *high* means that the site index is more than 115; *medium*, that it ranges from 75 to 115; and *low* that it is less than 75.

In the Amador Area, the effective depth of soil, if the average annual precipitation is sufficient to soak the soil by the beginning of the growing season, is the most important soil factor affecting site quality.

The effective depth is the depth to bedrock or to a layer that prevents or restricts penetration of roots. Texture has some effect on effective depth, but only if it is clayey enough to prevent penetration of roots or to restrict drainage. Generally, loose rocks or cobblestones in the profile have little effect on growth of trees, particularly if the soil is deep. In soils that are extremely rocky or cobbly, however, the rate of growth diminishes in proportion to the number of rocks present.

The hazard of erosion refers to the potential hazard of erosion of the soil. The length and steepness of the

slope and the texture and stability of the soil aggregates are considered in rating the erosion hazard. If soils are kept under a protective cover of forest litter and duff they generally do not erode. Consequently, the soils are rated according to their susceptibility to erosion if the cover is removed through fire, logging, trampling by animals, or other disturbances. The susceptibility of the soils to erosion if they are cultivated is not considered.

Equipment limitation refers to the characteristics of the soils that would restrict or prevent the use of equipment that is commonly used in tending and harvesting the trees. For example, Aiken loam, 0 to 16 percent slopes, has few equipment limitations except when it is wet. When this soil is wet, which could be 6 months out of a year, heavy equipment mires down. Tree planting machines can be used on this soil, however, at carefully selected times. Steep slopes and large boulders on the surface increase the limitation to use of equipment; sand or gravel decreases the limitation.

The hazards of insects and diseases depend on many properties and qualities of the soil, most of which are not well understood. Depth, texture, and inherent fertility of soil are probably the three most important factors. Observations indicate that on shallow, rocky soils, insects and diseases make the greatest inroads.

The hazard of windthrow is generally not serious, except on shallow soils derived from slate, shale, schist, or granitic material.

WOODLAND SUITABILITY GROUP 1

In this group the soils are loamy, cobbly, or rocky, or consist of a mixture of soil materials. They are nearly level to moderately steep.

The soils in this group are—

AhB	Aiken loam, 3 to 9 percent slopes.
AhC	Aiken loam, 9 to 16 percent slopes.
AkC	Aiken cobbly loam, 3 to 16 percent slopes.
CaC	Cohasset loam, 5 to 16 percent slopes.
CbC	Cohasset very cobbly loam, 3 to 16 percent slopes.
CoC	Cohasset very cobbly sandy loam, 3 to 16 percent slopes.
FgB	Fiddletown gravelly loam, deep, 3 to 10 percent slopes.
JnC	Josephine loam, deep, 9 to 16 percent slopes.
Lo	Loamy alluvial land.
Mo	Mixed alluvial land.
Mp	Mixed wet alluvial land.
SnB	Sites loam, 3 to 9 percent slopes.
SnC	Sites loam, 9 to 16 percent sloges.
SrC	Sites very rocky loam, 3 to 16 percent slopes.

These soils are of high site quality. The erosion hazard is slight, and equipment limitations are slight or moderate. Insect and disease hazards are slight or moderate, and the hazard of windthrow is slight. Manageability is good, except for Sites very rocky loam, 3 to 16 percent slopes, for which it is moderate.

The soils in this group are suited to intensive management. Trees grow rapidly on these soils, and moderate returns can be expected at an early age. Thinning and pruning can be done even after the trees have become fairly large. Logging is fairly easy, but in wet weather, heavy equipment is likely to bog down in low areas. At high elevations there is likely to be enough snow on the ground in winter to hinder use of equipment.

Locating and building roads is fairly easy on these soils. The roads need to be gravelled for year-round use. Also, the roads and skid trails should be protected from runoff water. Adequate ditches and culverts should be installed on the larger roads. Temporary and minor roads should be outsloped. The grade of the roads should not exceed 12 percent.

Fire is generally easier to control on these soils than on other soils in the Area, chiefly because the areas are easily accessible. Also, there are no steep slopes that would draw the fire to higher areas and increase its spread.

Areas where the trees have been removed by fire or other means can be prepared for planting fairly easily. Planting of trees can be done by machine in most places. Figure 14 shows terracing in woodland to protect the soil from erosion.

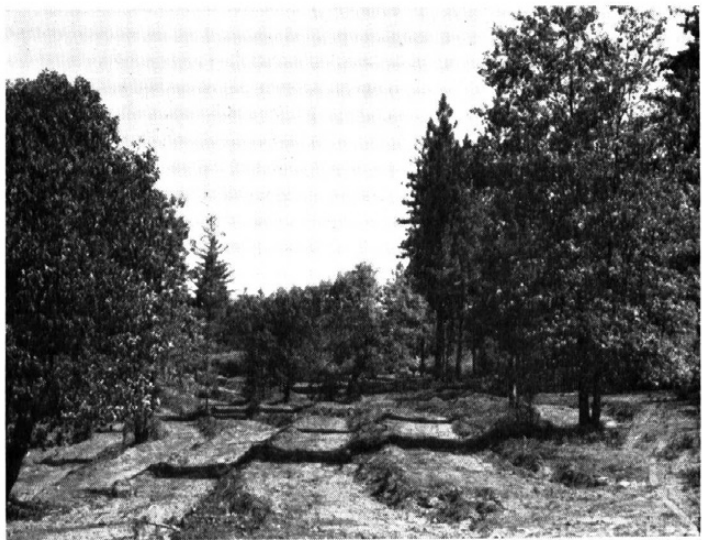

Figure 14.—**Terracing in woodland on a Sites loam.**

WOODLAND SUITABILITY GROUP 2

The soils in this group are cobbly, sandy, or very rocky loams that are gently sloping to moderately steep.

These soils are—

AkD	Aiken cobbly loam, 16 to 31 percent slopes.
HdC	Holland coarse sandy loam, deep, 5 to 9 percent slopes.
HdD	Holland coarse sandy loam, deep, 9 to 16 percent slopes.
MuB	Musick sandy loam, 3 to 9 percent slopes.
MuC	Musick sandy loam, 9 to 16 percent slopes.
MvC	Musick very rocky sandy loam, 9 to 16 percent slopes.

The soils in this group are of high site quality. Their erosion hazard is moderate. Equipment limitations are moderate, except for Holland coarse sandy loam, which has slight equipment limitations. Generally, insect and disease hazards are slight, but in Musick very rocky sandy loam, 9 to 16 percent slopes, they are moderate. The windthrow hazard is slight, and manageability is good.

These soils are suited to intensive management. Trees on them grow rapidly, and reasonable returns can be expected at an early age. Thinning and pruning can be started even after the trees have become fairly large. Logging is fairly easy because of the gentle slopes, and the likelihood of bogging down in wet weather is less than on soils of group 1. At high elevations, there is likely to be snow on the ground for a few months of the year.

Locating and building of roads is fairly easy, and the roads do not require gravelling for all-year use. Except for the Aiken soil, the soils erode readily and adequate ditches and culverts are needed on the larger roads. Temporary roads and minor roads should be outsloped;

cross ditching may also be needed to keep runoff from accumulating in wheel tracks. The grade of the roads should not exceed 8 percent. Extensive fill areas and landings should be mulched with slash or other suitable material available.

On these soils fire is about as easy to control as on soils in group 1. Soils left bare by fire or other means can be prepared for planting fairly easily, but bulldozing of brush should be across the slope. Planting by machine is feasible on all but the steeper areas of the Aiken soil.

WOODLAND SUITABILITY GROUP 3

The soils in this group are loamy, cobbly, sandy, or rocky. They are hilly to steep.

These soils are—

- AkE Aiken cobbly loam, 31 to 51 percent slopes.
- AmE Aiken very rocky loam, 16 to 51 percent slopes.
- CaD Cohasset loam, 16 to 31 percent slopes.
- CbE Cohasset very cobbly loam, 16 to 51 percent slopes.
- CoE Cohasset very cobbly sandy loam, 16 to 51 percent slopes.
- FtE Fiddletown very rocky loam, deep, 16 to 51 percent slopes.
- JnD Josephine loam, deep, 16 to 31 percent slopes.
- JnE Josephine loam, deep, 31 to 51 percent slopes.
- JpE Josephine very rocky loam, deep, 16 to 51 percent slopes.
- MkE McCarthy very rocky loam, 16 to 51 percent slopes.
- SnD Sites loam, 16 to 31 percent slopes.
- SnE Sites loam, 31 to 51 percent slopes.
- SrE Sites very rocky loam, 16 to 51 percent slopes.

All of these soils have high site quality, moderate erosion hazard, and severe equipment limitations. Insect and disease hazards are slight to moderate, and the hazard of windthrow is slight. Manageability is moderate to poor.

The soils in this group are suited to intensive management. Trees grow rapidly on them, and moderate returns can be expected at an early age. Because of the steepness of the slopes, however, it would be more costly to apply practices on these soils than on less steep soils.

The steep slopes of soils in this group make logging difficult in dry weather and impractical in wet weather. In winter, snow covers the ground at high elevations and hinders use of equipment.

Locating and constructing roads is more difficult on these soils than on those of groups 1 or 2. The grade of the road should not exceed 12 percent. These soils are stable, but the slope is steep and adequate ditches and culverts are required on the larger roads. Temporary and minor roads should be outsloped, and if necessary, cross ditched after use to keep water from concentrating in wheel tracks. If much of the soil is loosened in landings and skid trails, mulching with slash or other available material is needed.

Because of the steep slopes, fire is difficult to control on these soils. Soils left bare by fire or other means are difficult to prepare for reforestation. Planting by machine is feasible only on the gentler slopes, unless the steeper slopes are terraced.

WOODLAND SUITABILITY GROUP 4

In this group the soils are very rocky, very cobbly, or sandy loams. These soils are moderately steep to very steep.

The soils in this group are—

- AmF Aiken very rocky loam, 51 to 71 percent slopes.
- CbF Cohasset very cobbly loam, 51 to 71 percent slopes.
- HkE Holland very rocky coarse sandy loam, deep, 16 to 51 percent slopes.
- JpF Josephine very rocky loam, deep, 51 to 71 percent slopes.
- MkF McCarthy very rocky loam, 51 to 71 percent slopes.
- MuD Musick sandy loam, 16 to 31 percent slopes.
- MuE Musick sandy loam, 31 to 51 percent slopes.
- MvE Musick very rocky sandy loam, 16 to 51 percent slopes.
- MvF Musick very rocky sandy loam, 51 to 71 percent slopes.
- ScF Shaver very rocky coarse sandy loam, 51 to 71 percent slopes.
- SrF Sites very rocky loam, 51 to 85 percent slopes.

These soils have high site quality, but the erosion hazard and equipment limitations are severe. Insect and disease hazards are slight or moderate, except for the McCarthy very rocky loam, which has severe insect and disease hazards. The hazard of windthrow is slight or moderate. Manageability is poor.

Management practices that increase the growth and the quality of the trees can be used on these soils, but, because of the very steep slopes, they would be difficult and costly to apply.

Logging is difficult on these soils in dry weather and impractical in wet weather. At high elevations snow covers the ground in winter and hinders use of equipment.

Locating and constructing roads is difficult on the steeper slopes and in places is not feasible. The grade of roads should not exceed 8 percent. On the major roads, adequate ditches and culverts should be installed. After use, temporary roads and minor roads should be outsloped and cross ditched and landings and skid trails should be mulched with slash or other suitable material.

Fire control is difficult on these soils. Trees will probably have to be planted by hand on soils that have been left bare through fire or other means. Machine planting is suitable on terraced soils.

WOODLAND SUITABILITY GROUP 5

In this group the soils are cobbly, gravelly, or loamy and are gently sloping to moderately steep.

The soils in this group are—

- CcC Cohasset very cobbly loam, moderately deep, 3 to 16 percent slopes.
- FdC Fiddletown gravelly loam, 9 to 16 percent slopes.
- JmC Josephine loam, 3 to 16 percent slopes.
- JoC Josephine very rocky loam, 3 to 16 percent slopes.
- MlC McCarthy very cobbly loam, 3 to 16 percent slopes.
- SoC Sites loam, moderately deep, 3 to 16 percent slopes.
- WcD Windy cobbly sandy loam, 9 to 16 percent slopes.

These soils are all of medium site quality. The erosion hazard is slight. Equipment limitations are slight to moderate, except for the Josephine very rocky loam, which has severe equipment limitations. The insect and disease hazards are moderate or severe. Generally, the hazard of windthrow is slight, but on the Sites loam it is medium. Manageability is moderate, except for Josephine very rocky loam, which has poor manageability.

Growth of trees on these soils is moderate. Intensive management practices can be applied, but returns cannot be expected so soon as on soils in groups 1 through 4. Pruning should be done only when the trees are less than 15 inches in diameter at breast height. Damage is likely from insects and diseases, and care is required to prevent it. Logging is fairly easy, but heavy equipment bogs down in low areas if the weather is wet. At high elevations snow is likely to cover the ground in winter and hinder use of equipment.

Locating and building roads is fairly easy, but the roads need to be gravelled in places for year-round use. The

grade of the roads should not be more than 12 percent. Ditches and culverts should be installed in the major roads, and minor roads or temporary roads should be outsloped.

Because of the gentle slopes, fire control is not difficult on these soils. Except for the Fiddletown gravelly loam, the Josephine loam, and the Sites loam, soils that have been left bare by fire can be prepared for planting fairly easily. In places machine planting might not be feasible because of the cobblestones and rocks in and on the soil.

WOODLAND SUITABILITY GROUP 6

In this group the soils are loams or gravelly or sandy loams. These soils are strongly sloping to steep.

The soils in this group are—

- FdD Fiddletown gravelly loam, 16 to 31 percent slopes.
- HcC Holland coarse sandy loam, 5 to 9 percent slopes.
- HcD Holland coarse sandy loam, 9 to 16 slopes percent.
- JmD Josephine loam, 16 to 31 percent slopes.
- JmE Josephine loam, 31 to 51 percent slopes.
- SoD Sites loam, moderately deep, 16 to 31 percent slopes.
- SoE Sites loam, moderately deep, 31 to 51 percent slopes.
- SpD3 Sites clay loam, moderately deep, 3 to 31 percent slopes, severely eroded.

These soils are of medium site quality. The erosion hazard is moderate. Equipment limitations are severe, except on Holland coarse sandy loam, 5 to 9 percent slopes; they are moderate on this soil. Insect and disease hazards are moderate on the soils of this group. The hazard of windthrow is slight or moderate. Manageability is moderate.

Trees on these soils grow at a medium rate. Nevertheless, other characteristics are favorable enough that fairly intensive management can be applied at low cost. Moderate returns can be expected, but not in so short a time as on soils in suitability groups 1 through 4. Pruning should be done only on trees that are less than 15 inches in diameter at breast height. Damage from insects and diseases is likely, and care is required to prevent it.

Logging is fairly easy in dry weather but impractical in wet weather, except on the Holland and Fiddletown soils. At high elevations snow covers the ground in winter and hinders use of equipment.

Locating and constructing roads is difficult on these soils. Except for the Holland soils, the soils are not highly erodible. Nevertheless, adequate ditches and culverts should be installed on the major roads. Minor roads or temporary roads should be outsloped, and if necessary, cross ditched. The grade of the roads should not exceed 12 percent. Landings and skid trails should be mulched if the soil has been much loosened through use.

Fire control is moderately difficult on these soils. Soils left bare by fire or other means are fairly easy to prepare for planting. Planting by machine would not be feasible, however, except on the gentler slopes, unless the steeper slopes are terraced.

WOODLAND SUITABILITY GROUP 7

In this group the soils are very cobbly, very rocky, or coarse sandy loams. These soils are moderately steep to steep.

The soils in this group are—

- CcE Cohasset very cobbly loam, moderately deep, 16 to 51 percent slopes.
- FoE Fiddletown very rocky loam, 16 to 51 percent slopes.
- HfD Holland very rocky coarse sandy loam, 9 to 16 percent slopes.
- JoE Josephine very rocky loam, 16 to 51 percent slopes.
- JsE Josephine very rocky loam, 16 to 51 percent slopes; in mapping unit JsE, Josephine-Maymen complex, 16 to 51 percent slopes.
- JxE Josephine very rocky loam, 16 to 51 percent slopes; in mapping unit JxE, Josephine-Mariposa complex, 16 to 51 percent slopes.
- MmE McCarthy very cobbly loam, 16 to 51 percent slopes; in mapping unit MmE, McCarthy and Jiggs very cobbly loams, 16 to 51 percent slopes.
- SsE Sites very rocky loam, moderately deep, 16 to 51 percent slopes.
- StE Sites very rocky loam, moderately deep, 16 to 51 percent slopes; in mapping unit StE, Sites-Mariposa complex, 16 to 51 percent slopes.
- TcE Tiger Creek very rocky loam, 16 to 51 percent slopes.
- WcE Windy cobbly sandy loam, 16 to 51 percent slopes.

These soils are of medium site quality. The erosion hazard is moderate and equipment limitations are severe. Insect and disease hazards are severe. The hazard of windthrow is slight or moderate. Manageability is poor.

Trees on these soils grow at a moderate rate. Intensive practices can be applied, but applying them would be costly because of the steep slopes. Reasonable returns cannot be expected so early as on groups 1 through 4. Pruning should be done only on trees less than 15 inches in diameter at breast height. The hazard from insects and diseases is high, and management that controls damage from insects and diseases is needed.

Logging is difficult in all kinds of weather, but in wet weather logging probably could be done on the cobbly, gravelly, and rocky soils in places. At high elevations the snow is sometimes so deep that logging is impractical in winter.

Locating and constructing roads is difficult, but in most places gravelling would be needed only in the very wet places to make the roads usable the year round. In major roads, ditches and culverts should be installed; minor roads or temporary roads should be outsloped and, if needed, cross ditched.

Fire control is difficult on these soils. Soils left bare by fire or other means are difficult to prepare for planting. Planting by machine would probably not be feasible, because of the slope and the rocks in the soil.

WOODLAND SUITABILITY GROUP 8

In this group are rocky or coarse sandy loams that are moderately steep to very steep.

The soils in this group are—

- FoF Fiddletown very rocky loam, 51 to 71 percent slopes.
- HcE Holland coarse sandy loam, 16 to 36 percent slopes.
- HfE Holland very rocky coarse sandy loam, 16 to 51 percent slopes.
- HfF Holland very rocky coarse sandy loam, 51 to 71 percent slopes.
- JgE Jiggs very rocky loam, 16 to 51 percent slopes.
- JoF Josephine very rocky loam, 51 to 71 percent slopes.
- JxF Josephine very rocky loam, 51 to 71 percent slopes, in mapping unit JxF, Josephine-Mariposa complex, 51 to 71 percent slopes.
- MmE Jiggs very cobbly loam, 16 to 51 percent slopes; in mapping unit MmE, McCarthy and Jiggs very cobbly loams, 16 to 51 percent slopes.
- MwE Musick very rocky sandy loam, moderately deep, 16 to 51 percent slopes.
- MwF Musick very rocky sandy loam, moderately deep, 51 to 71 percent slopes.
- MxF Musick extremely rocky sandy loam, moderately deep, 51 to 71 percent slopes.
- SdF Shaver very rocky coarse sandy loam, moderately deep, 51 to 71 percent slopes.

These soils are of medium site quality. The erosion hazard and equipment limitations are severe. Insect and disease hazards are moderate or severe. The hazard of windthrow is slight or moderate. Manageability is generally poor, but for Holland coarse sandy loam, 16 to 36 percent slopes, it is moderate.

Trees on these soils grow at a moderate rate. Nevertheless, other favorable soil qualities are lacking and returns would justify only simple management practices. Practices should be those that protect the trees from insects, diseases, fire, overgrazing, and other harmful factors. Generally, trees that are more than 10 inches in diameter at breast height should not be pruned.

Logging is difficult, but except for deep snow, weather is not a hindrance.

Roads are difficult to locate and construct, but if a road is constructed, gravelling probably would not be necessary to make it suitable for use in all weather. Most of the soils erode readily, and care should be taken to protect roads, skid trails, and landings from erosion after use.

Fire control is difficult on these soils. Soils left bare by fire or other means are difficult to prepare for planting. Seedlings must be planted by hand.

WOODLAND SUITABILITY GROUP 9

In this group the soils are gravelly, very stony, or very rocky and are moderately steep to very steep. The soils in this group are—

- IsE Iron Mountain very stony loam, 9 to 51 percent slopes.
- IvE Iron Mountain very stony loam, rhyolite substratum, 9 to 51 percent slopes.
- JsE Maymen very rocky loam, 16 to 51 percent slopes; in mapping unit JsE, Josephine-Maymen complex, 16 to 51 percent slopes.
- JxE Mariposa very rocky loam, 31 to 51 percent slopes; in mapping unit JxE, Josephine-Mariposa complex, 16 to 51 percent slopes.
- JxF Mariposa very rocky loam, 51 to 71 percent slopes; in mapping unit JxF, Josephine-Mariposa complex, 51 to 71 percent slopes.
- MbD Mariposa gravelly loam, 3 to 31 percent slopes.
- McD Mariposa very rocky loam, 9 to 31 percent slopes.
- McE Mariposa very rocky loam, 31 to 51 percent slopes.
- McF Mariposa very rocky loam, 51 to 85 percent slopes.
- MdE Mariposa very rocky loam, 16 to 51 percent slopes; Maymen very rocky loam, 16 to 51 percent slopes; in mapping unit MdE, Mariposa-Maymen complex, 16 to 51 percent slopes.
- MdF Mariposa very rocky loam, 51 to 85 percent slopes; Maymen very rocky loam, 51 to 85 percent slopes; in mapping unit MdF, Mariposa-Maymen complex, 51 to 85 percent slopes.
- MgE Maymen very rocky loam, 9 to 51 percent slopes;
- MhE Maymen very rocky loam, 16 to 51 percent slopes; Mariposa very rocky loam, 16 to 51 percent slopes; in mapping unit MhE, Maymen-Mariposa complex, 16 to 51 percent slopes.
- StE Mariposa very rocky loam, 16 to 51 percent slopes; in mapping unit StE, Sites-Mariposa complex, 16 to 51 percent slopes.

These soils are of low site quality. The hazard of erosion is moderate or severe. Equipment limitations and insect and disease hazards are severe. The hazard of windthrow is severe, except for the Iron Mountain very stony loam, rhyolite substratum where it is slight. Manageability is poor.

The soils in this group have a low growth potential, are severely limited, and are subject to high hazards. Therefore, it is unlikely that any but the simplest management practices would yield, from forest products alone, a reasonable return on the investment. These soils, however, have value for recreation, for wildlife, and as watershed, and additional investment could probably be justified. Fire protection is difficult but is necessary, even for low yields.

Wildlife

The suitability of different parts of the Amador Area for wildlife is discussed in this section. Each farm or ranch is a complex community made up of many kinds of plants and animals. The abundance and kind of wildlife in a particular area depend upon the food and vegetative cover produced by the soils there. A successful habitat for wildlife can be maintained only if all living things in it are in biologic balance. The biologic balance generally can be changed to favor desirable species of wildlife by providing better habitats for them. Desirable kinds of wildlife help to destroy insect pests, rodents, and weed seeds. Among the desirable kinds of wildlife in the Area are many kinds of game birds, large game animals, waterfowl, and fish. There are also many kinds of songbirds and small mammals that depend on farmlands for food and shelter.

Game and fish are important to recreation in the Area. They can be encouraged to live in a particular area if their needs are considered. No two kinds of wildlife have the same requirements, but all kinds need food, cover, and water. Food must be plentiful and close to cover that will furnish protection from enemies and weather. The cover must conceal the nests and young and provide shelter from hot sun and chilling rain. Overgrazing by livestock and uncontrolled burning are harmful to wildlife. The kinds of habitat preferred by wildlife in the Area are discussed in the paragraphs that follow.

In the rolling oak-grass country in the western part of the Area, valley quail, mourning doves, ducks, geese, band-tailed pigeons, and a few pheasants are the most common game birds. Here the Auburn, Supan, Mokelumne, and Red Bluff soils can be improved for quail if selective cutting of oak is done and the brush from the trees is stacked in small piles to help provide escape cover. Water is scarce in places, especially for quail, which have a limited range of about one-quarter of a mile in radius. If seeps, springs, stock ponds, or streams are too distant, the placing of guzzlers, simple modifications of livestock watering facilities, or other watering devices helps increase the number of quail.

In croplands in the western part of the Area, the Honcut, Ryer, Sierra, Snelling, and other arable soils provide ample food and water for wildlife. These areas can be improved for upland game birds through the use of cover crops, stubble mulching, tillage, crop rotations, fertilizer, and other practices that improve yields. Planting of hedgerows also improves the areas for wildlife. Clean plowing, burning, early mowing of watercourses, and indiscriminate use of insecticides and weedkillers are harmful to most kinds of wildlife.

In the low foothills the Iron Mountain, Exchequer, Henneke, and other soils that are low in productivity and covered with brush have little value for agriculture. Mature stands of brush provide little food for wildlife. The new growth of leaders in dense, old stands of brush is beyond the reach of deer, especially the fawns, and the

dense overstory shades out grass and forbs. The areas can be improved for quail, deer, and other wildlife by removing brush and stacking some of it in small piles to provide cover, especially for quail. Then grass and forbs can revegetate on the cleared areas and provide additional food for wildlife. Supplementary water must be provided in places for quail. On some ranches the quail habitat is good, and the areas provide supplementary income if leased for hunting.

Waterfowl, especially Canada geese, use the reservoirs in the foothills as resting and drinking places in winter. Mallards, cinnamon teal, and woodducks nest near the reservoirs in summer. Woodducks like hollow trees near water as nesting places. Their number increases markedly if nesting boxes are placed in trees near reservoirs and streams.

The coniferous forests in mountainous areas provide habitats in places for mountain quail, band-tailed pigeons, doves, deer, and bears. On the better forest soils, such as the Aiken, Cohasset, and Musick, the dense canopy of trees and thick mat of pine needles limit the growth of grass, forbs, and tender shoots of shrubs that would provide browse for game. Stands of brush on the shallow Mariposa, Maymen, and Iron Mountain soils, however, are extensive in places. In these places providing browseways for the animals and firebreaks to protect the trees would also benefit wildlife. Stacking brush in cleared areas provides escape cover for quail. Deer like to feed on sweet birch, scrub oak, and ceanothus. Bears prefer manzanita berries, coffee berries, and similar fruiting plants. If large areas of forest are clear cut, burned, or grazed by stock, and if den trees are removed, the number of bears decreases. Newly planted orchards, vineyards, and gardens in these areas require fencing to prevent damage by deer. Deer are also likely to damage young conifers.

Throughout the Area, there are several kinds of rodents that are considered agricultural pests because of the severe damage they cause. Pocket gophers, ground squirrels, jackrabbits, field mice, brown rats, porcupines, and in places, muskrats and beavers, cause damage to earthfill dams, ditches, and other water structures. Porcupines damage young plantings of conifers as well as native trees. The unfavorable market price for long-haired fur has almost stopped commercial trapping of fur-bearing animals. As a result, the number of skunks has increased considerably, and skunks are now a problem in the control of rabies in the Area. Coyotes, wildcats, gray foxes, and raccoons are the main predators throughout the Area, but there are also mountain lions, or cougars, in places. Stray dogs and dog packs cause damage to livestock and deer in some areas.

Rattlesnakes are numerous, especially in rocky areas adjoining watering places. The redheaded woodpecker damages fenceposts, buildings, and other wood structures. The California bluejay is likely to be a nuisance in orchards.

At higher elevations the lakes and streams are stocked with trout. At lower elevations black bass, bluegill, and catfish are numerous in the lakes and streams. Salmon and steelhead formerly spawned in most major streams, but construction of the Pardee Reservoir on the Mokelumne River prevents spawning in most places. However, a large artificial spawning channel for salmon and steelhead is being planned for construction below the Camanche Dam.

There are many reservoirs and stockwater dams in the Area, and most of them are stocked with fish. Trout can be planted in those bodies of water that stay at a temperature of less than 75° F. in summer. In the warmer ponds large-mouthed black bass, bluegill, red-eared sunfish, and catfish can be stocked. Bass and bluegill can generally be obtained from the Department of Fish and Game for initial stocking of ponds, or they can be purchased. One planting is generally all that is required. Trout generally must be restocked annually or biannually, and the fish must be purchased. A stocking permit is required if any stocking is done. Ponds that are stocked can provide supplemental income for the owner in return for their recreational use.

Engineering Interpretations [4]

Soils engineering deals with soil as structural material and as foundation material upon which structures are built. In a broad sense, it is fundamental to many other branches of engineering. Engineering properties of soils vary widely even within the limits of a single construction project, and generally, soils must be used where they occur and in the condition in which they are found. Consequently, much of the practice of soils engineering is concerned with locating and classifying soil materials, determining the engineering properties of the available soils, correlating properties of these soils with the requirements of the job, and selecting appropriate materials for each job from those available.

This section contains general soils information useful for engineering interpretations. The soil map and soil descriptions, as well as the engineering data given in tables in this section, can be used by engineers to make preliminary studies of a site where construction is planned and to predict behavior of the particular soils at the proposed site. By using the information in the soil survey report, the soils engineer can concentrate on the most suitable kinds of soil. Then a more detailed study of those soils can be made at a minimum cost.

The information about soil properties is not specific enough for all engineering purposes and should not be used in lieu of detailed investigations of the site. It should be used only in planning more detailed engineering field surveys to determine the in-place condition of soils at the site of the proposed engineering structure.

Engineering classification systems

Most highway engineers classify soils in accordance with the classification developed by the American Association of State Highway Officials (AASHO) (*1*, *21*). In this system soil materials are classified in seven principal groups. The groups range from A–1, which consists of gravelly soils of high bearing capacity, to A–7, which consists of clayey soils having low strength when wet. Within each group the relative engineering value of the soil material is indicated by a group index number. Group index numbers range from 0 for the best material to 20 for the poorest. The group index number is shown in parentheses, following the soil group symbol in table 4.

Some engineers, particularly those who work on the

[4] By R. A. Miller, engineer, Soil Conservation Service.

design of dams and airfields, prefer the Unified soil classification (*30, 21*). In this system soil materials are classified as coarse grained, 8 classes; fine grained, 6 classes; and highly organic. Compressibility and plasticity are important features in this classification. The last column of table 4 gives the classification of the tested soils of Amador Area according to the Unified system.

Engineering test data

Test data for each of eight extensive series in the Area are given in table 4. Samples from 15 soils taken in representative sites of the eight series were tested in the laboratory of District X, California State Division of Highways. The data in table 4 show the mechanical analysis, liquid limit, plasticity index, moisture-density relationship, and the classification of the samples under the American Association of State Highway Officials (AASHO) system and the Unified system.

Mechanical analyses of the samples were made to determine the relative proportions of the different sizes of particles in the soil material. The size and proportions of the particles affect the behavior of soil material when it is used for engineering purposes. Some terms used by soil scientists, as terms for soil texture, have different meaning to engineers. For example, clay, in present usage of many soil laboratories, refers to mineral grains less than 0.002 millimeter in diameter; engineering tests report as clay the mineral grains less than 0.005 millimeter

TABLE 4.—*Engineering test*

Name of soil and type location	Parent material	California Division of Highways report number	Riverside Soils Laboratory report number	Depth	Horizon	Mechanical analysis [1]— Percentage passing sieve—		
						No. 4 (4.76 mm.)	No. 8 (2.38 mm.)	No. 16 (1.19 mm.)
				Inches				
Aiken loam:								
SW¼ of NE¼ of sec. 34, T. 8 N., R. 13 E.	Andesitic conglomerate.	59–3217	11348	0–15	A1	100	96	91
		59–3218	11352	49–59	B21	--------	100	99
		59–3219	11355	84–92	B32	--------	100	99
SW. corner of NE¼ of sec. 33, T. 8 N., R. 13 E.	Andesitic conglomerate.	59–3220	11356	0–9	A1	100	98	91
		59–3221	11361	54–69	B22	--------	100	99
		59–3222	11363	92–100	B3	--------	100	99
Ahwahnee loam:								
NE¼ of SW¼ of sec. 36, T. 8 N., R. 10 E.	Granodiorite.	59–3238	59345	0–7	Ap	100	98	92
		59–3239	59347	16–28	B2	100	94	88
		59–3240	59348	28–37+	Dr	100	84	70
SE¼ of SE¼ of sec. 31, T. 8 N., R. 11 E.	Granodiorite.	59–3235	59340	0–9	A1	100	99	96
		59–3236	59342	16–27	B2	100	98	95
		59–3237	59344	32–36+	Dr	100	99	91
Auburn silt loam:								
300 feet NE. of SW. corner, sec. 7, T. 7 N., R. 9 E.	Amphibolite schist.	59–3216	59311	1–7	A12	100	97	94
¼ mile W. and 100 feet N. of SE. corner, sec. 6, T. 6 N., R. 9 E.	Amphibolite schist.	59–3215	59307	1½–9	A12	100	96	92
Josephine gravelly loam:								
0.35 mile N. of SE. corner, sec. 24, T. 7 N., R. 11 E.	Metasedimentary rocks (Calaveras formation).	[7] 60–3783	60129	2–9	A3	91	88	85
		60–3780	60131	22–37	B2	--------	100	97
		60–3779	60132	37–47	B3	100	99	98
Musick sandy loam:								
SE¼ of SE¼ of sec. 19, T. 7 N., R. 13 E.	Granodiorite.	59–3226	59332	0–14	Ap	100	99	97
		59–3227	59335	29–47	B22	100	99	98
		59–3228	59338	74–97	C1	--------	--------	100

See footnotes at end of table.

in diameter. These and other terms used by soil scientists are defined in the "Soil Survey Manual" (*27*).

Moisture-density relations, the relation of moisture content and the density to which a soil material can be compacted, are important for engineering purposes. If soil material is compacted at successively higher moisture content, assuming that the compactive effort remains constant, the density of the compacted material increases until the optimum moisture content is reached. After that, the density decreases with increase in moisture content. The moisture content at which the maximum dry density is obtained is the optimum moisture content.

The tests to determine liquid limit and plastic limit measure the effect of water on consistence of the soil material. As the moisture content of a clayey soil increases from a very dry state, the material changes from a solid to a semisolid or plastic state. As the moisture content is further increased, the material changes from a plastic to a liquid state. The *plastic limit* is the moisture content at which the soil material passes from a semisolid to a plastic state. The *liquid limit* is the moisture content at which the soil material changes from a plastic to a liquid state. The *plasticity index* is the numerical difference between the liquid limit and the plastic limit. It indicates the range of moisture content within which a soil material is in a plastic condition. A nonplastic soil is a soil that is granular or without cohesion for which the liquid or plastic limit cannot be determined.

data for Amador Area, Calif.

Mechanical analysis [1]—Continued							Liquid limit	Plasticity index	Moisture-density [2]		Density in place [3]	Classification	
Percentage passing sieve—Continued			Percentage smaller than—										
No. 30 (0.59 mm.)	No. 100 (0.149 mm.)	No. 200 (0.074 mm.)	0.05 mm.	0.02 mm.	0.005 mm.	0.002 mm.			Maximum dry density	Optimum moisture content		AASHO [4]	Unified [5]
									Lb. per cu. ft.	*Percent*	*Lb. per cu. ft.*		
84	65	53	43	30	16	10	42	6	88	30	65	A-5(4)	ML.
97	91	84	72	64	48	37	50	17	96	27	87	A-7-5(13)	ML.
96	85	79	74	62	46	37	51	15	92	27	82	A-7-5(12)	ML.
83	64	54	46	34	19	10	46	8	86	32	61	A-5(4)	ML.
96	84	77	73	67	52	42	53	19	92	30	84	A-7-5(14)	MH.
96	85	78	69	64	48	39	50	14	89	34	79	A-7-5(12)	ML.
81	61	51	38	28	13	7	27	4	126	7	86	A-4(3)	ML-CL.
80	61	56	40	28	14	9	24	3	133	9	100	A-4(4)	ML.
61	41	33	24	16	6	4	27	3	133	9	112	A-2-4(0)	SM.
83	63	56	40	30	14	9	27	4	127	10	98	A-4(4)	ML-CL.
86	67	57	44	32	17	11	27	7	128	10	98	A-4(4)	ML-CL.
79	54	42	32	22	8	5	27	3	134	10	98	A-4(1)	SM.
91	81	76	64	47	18	11	26	4	122	15	[6]	A-4(8)	ML-CL.
88	78	73	65	52	25	14	28	7	122	13	[6]	A-4(8)	ML-CL.
81	76	63	54	40	24	15	29	[8]	115	14	[6]	A-4(6)	ML.
95	85	80	74	62	45	39	46	14	107	20	[6]	A-7-5(11)	ML.
94	86	81	75	62	43	34	46	13	108	19	[6]	A-7-5(10)	ML.
93	70	56	40	33	19	12	38	7	94	23	62	A-4(4)	ML.
94	76	67	57	51	38	32	49	15	104	21	88	A-7-5(10)	ML.
94	65	51	46	36	24	19	41	8	108	18	92	A-5(3)	ML.

TABLE 4.—*Engineering test data*

Name of soil and type location	Parent material	California Division of Highways report number	Riverside Soils Laboratory report number	Depth	Horizon	Mechanical analysis [1]— Percentage passing sieve— No. 4 (4.76 mm.)	No. 8 (2.38 mm.)	No. 16 (1.19 mm.)
Pentz sandy loam:				*Inches*				
0.1 mile S. of center of NW¼ of sec. 30, T. 5 N., R. 10 E.	Rhyolitic tuff (Valley Springs formation).	60–3785	6085	0–5	A11	--------	--------	100
		60–3782	6089	28–45+	C2	100	90	82
0.2 mile N. of center of SE¼ of sec. 9, T. 5 N., R. 9 E.	Rhyolitic tuff (Valley Springs formation).	60–3781	60–91	0–5	A11	99	99	97
		60–3784	6095	28–46+	C3	100	98	93
NE¼ of NW¼ of sec. 1, T. 6 N., R. 12 E.	Granodiorite.	59–3223	59326	9–20	A3	--------	100	98
		59–3224	59329	39–58	B22	--------	100	98
		59–3225	59331	78–100+	B3	--------	100	98
Sierra coarse sandy loam:								
SW¼ of SW¼ of sec. 29, T. 8 N., R. 11 E.	Granodiorite.	59–3232	59349	0–8	Ap	100	98	91
		59–3233	59352	27–48	B2	--------	100	96
		59–3234	59354	68–78+	C1	--------	100	96
NE¼ of SE¼ of sec. 19, T. 8 N., R. 11 E.	Granodiorite.	59–3229	59355	0–6	Ap	100	98	90
		59–3230	59359	33–45	B22	100	99	92
		59–3231	59361	66–73	C1	100	97	91
Sites loam:								
NE. corner of sec. 9, T. 6 N., R. 12 E.	Schist (Calaveras formation).	[9] 59–3209	59278	0–8	A11p	86	80	77
		[9] 59–3210	59280	15–27	B11	90	88	84
		[10] 59–3211	59283	45–55	B22	89	86	85
¼ mile E. of center of sec. 21, T. 6 N., R. 12 E.	Schist (Calaveras formation).	59–3212	59287	2½–7	A12	100	96	91
		59–3213	59290	27–44	B2	100	96	94
		59–3214	59292	62–72	C1	100	96	95

[1] Tests performed by District X, California Division of Highways, in accordance with procedures given in the "California Materials Manual for Testing and Control Procedures." Results by this procedure may differ somewhat from results that would have been obtained by the soil survey procedure of the Soil Conservation Service (SCS). In the California procedure, the fine material is analyzed by the hydrometer method and the various grain-size fractions are calculated on the basis of all the material, including that coarser than 2 millimeters in diameter. In the SCS soil survey procedure, the fine material is analyzed by the pipette method and the material coarser than 2 millimeters in diameter is excluded from calculations of grain-size fractions. The mechanical analyses used in this table are not suitable for use in naming textural classes of soils.

[2] Moisture-density tests performed by the 5-layer procedure of the California Division of Highways. Results of this procedure generally differ from values obtained in the 3-layer procedure used by the American Association of State Highway Officials (AASHO).

[3] Density in place tests performed by SCS from undisturbed core samples.

Soil properties significant to engineering

In tables 5 and 6 soil properties significant to some engineering work are given. Interpretations of the different soils for irrigation are not given, because engineers in this Area commonly use the agricultural classification of soils presented in other parts of the report in planning an irrigation system. Also, soil complexes are not listed in the tables. For characteristics of the complexes, refer to the individual soil series or land types that make up the complex.

Table 5 lists the soils in the Area and the map symbols for each and gives a brief description of the soils and of their estimated characteristics and properties. It also gives the textural classification of the U.S. Department of Agriculture, estimates of the Unified classification, and estimates of the classification used by the American Association of State Highway Officials. In addition, the permeability, available water capacity, reaction, and shrink-swell potential are estimated. The estimates are

for Amador Area, Calif.—Continued

Mechanical analysis [1]—Continued							Liquid limit	Plasticity index	Moisture-density [2]		Density in place [3]	Classification	
Percentage passing sieve—Continued			Percentage smaller than—						Maximum dry density	Optimum moisture content		AASHO [4]	Unified [5]
No. 30 (0.59 mm.)	No. 100 (0.149 mm.)	No. 200 (0.074 mm.)	0.05 mm.	0.02 mm.	0.005 mm.	0.002 mm.							
									Lb. per cu. ft.	*Percent*	*Lb. per cu. ft.*		
94	56	39	34	22	13	9	([8])	([8])	107	11	([6])	A-4(1)_____	SM.
68	37	26	23	13	7	4	([8])	([8])	97	16	([6])	A-2-4(0)___	SM.
95	69	46	41	28	15	10	([8])	([8])	102	18	([6])	A-4(2)_____	SM.
90	46	29	25	16	7	4	([8])	([8])	88	24	([6])	A-2-4(0)___	SM.
91	61	50	42	34	22	16	26	6	118	15	76	A-4(3)_____	SM-SC.
90	61	50	43	33	26	22	40	11	108	17	96	A-6(3)_____	SM.
89	66	54	51	37	22	17	42	10	107	17	82	A-5(4)_____	ML.
75	54	45	37	27	16	11	28	5	124	10	([6])	A-4(2)_____	SM-SC.
85	73	67	60	50	35	30	42	17	117	14	102	A-7-6(10)__	ML-CL.
86	66	53	41	30	15	12	30	5	127	10	106	A-4(4)_____	ML.
76	56	48	35	27	16	11	30	5	121	10	91	A-4(3)_____	SM.
81	65	53	45	35	22	16	29	7	126	11	109	A-4(4)_____	ML-CL.
80	56	45	35	23	10	8	30	3	127	10	111	A-4(2)_____	SM.
74	65	59	41	31	19	16	32	5	110	16	71	A-4(5)_____	ML.
82	75	65	50	41	28	21	28	6	116	15	79	A-4(6)_____	ML-CL.
83	79	70	56	50	40	35	45	21	113	18	([6])	A-7-6(12)__	CL.
87	79	61	44	30	18	12	23	1	119	12	84	A-4(5)_____	ML.
92	88	81	67	55	46	39	48	20	111	15	96	A-7-6(14)__	ML-CL.
93	84	71	56	30	25	20	39	8	117	13	103	A-4(7)_____	ML.

[4] Based on American Association of Highway Officials Designation: M 145-49 (*1*).

[5] Based on the Unified soil classification system (*30*). SCS and Bureau of Public Roads have agreed to consider that all soils having plasticity indexes within two points from A-line are to be given a borderline classification. Examples of borderline classifications obtained by this use are SM–SC and ML–CL.

[6] Not determined.

[7] In this sample, 95 percent passed the ¾-inch sieve and 100 percent passed the 2½-inch sieve.

[8] Nonplastic.

[9] In this sample, 97 percent passed the ¾-inch sieve and 100 percent passed the 1½-inch sieve.

[10] In this sample, 100 percent passed the ¾-inch sieve.

based partly on examinations made in the field and partly on results of test data given in table 4. Since the estimates are only for typical soils, considerable variation from these values should be anticipated. More information on the range of properties of the soils can be obtained in other sections of the report.

The brief description of the soil gives the texture and thickness of significant horizons and is the most extensive mapping unit in the series.

The available water capacity, expressed in inches per inch of soil depth, is the approximate amount of capillary water held in the soil when wet to field capacity. This amount of water will wet air-dry soil to a depth of 1 inch without deeper percolation. In general, the amount of water in a soil available to plants 3 days after free water from a good rain or thorough irrigation has been removed by drainage can be assumed to be the available water capacity of that soil.

TABLE 5.—*Estimated characteristics and*

Map symbol	Soil	Brief description of soil	Depth from surface	Classification
				USDA texture
			Inches	
AaB	Ahwahnee loam, 3 to 9 percent slopes.	About 3 feet of loam on strongly weathered granitic rock.	0–32	Loam
AaB2	Ahwahnee loam, 3 to 9 percent slopes, eroded.		32+	Weathered granitic rock.
AaC	Ahwahnee loam, 9 to 16 percent slopes.			
AaC2	Ahwahnee loam, 9 to 16 percent slopes, eroded.			
AaD	Ahwahnee loam, 16 to 31 percent slopes.			
AaD2	Ahwahnee loam, 16 to 31 percent slopes, eroded.			
AdD	Ahwahnee very rocky loam, 9 to 31 percent slopes.			
AdD3	Ahwahnee very rocky loam, 16 to 31 percent slopes, severely eroded.			
AdE	Ahwahnee very rocky loam, 31 to 51 percent slopes.			
AeE	Ahwahnee very rocky loam, shallow, 16 to 51 slopes.			
AfD	Ahwahnee extremely rocky loam, 9 to 51 percent slopes.			
AhB	Aiken loam, 3 to 9 percent slopes.	About 2 feet of cobbly loam, 1 foot of cobbly clay loam, and about 5 feet of cobbly clay over deeply weathered, volcanic conglomerate. In the cobbly loams, cobblestones make up as much as 25 percent of the soil mass.	0–24	Cobbly loam
AhC	Aiken loam, 9 to 16 percent slopes.		24–37	Cobbly clay loam
AkC	Aiken cobbly loam, 3 to 16 percent slopes.		37–92	Cobbly clay
AkD	Aiken cobbly loam, 16 to 31 percent slopes.		92+	Deeply weathered, volcanic conglomerate.
AkE	Aiken cobbly loam, 31 to 51 percent slopes.			
AmE	Aiken very rocky loam, 16 to 51 percent slopes.			
AmF	Aiken very rocky loam, 51 to 71 percent slopes.			
AnD	Argonaut gravelly loam, 3 to 31 percent slopes.	About ½ foot of gravelly heavy loam and 1½ feet of clay over deeply weathered meta-andesite.	0–6	Gravelly heavy loam
AoD	Argonaut very rocky loam, 3 to 31 percent slopes.		6–10	Gravelly heavy clay loam.
			10–21	Clay
			21–27+	Deeply weathered meta-andesite.
ApD	Auburn silt loam, 0 to 31 percent slopes.	About 1 foot of silt loam and about 1 foot of heavy silt loam over partly weathered, metabasic rock.	0–9	Silt loam
ArC	Auburn silt loam, moderately deep, 3 to 16 percent slopes.		9–14	Heavy silt loam
ArD	Auburn silt loam, moderately deep, 16 to 31 percent slopes.		14+	Weathered, metabasic rock.
AsB2	Auburn very rocky silt loam, 3 to 9 percent slopes, eroded.			
AsD	Auburn very rocky silt loam, 3 to 31 percent slopes.			
AsE	Auburn very rocky silt loam, 31 to 51 percent slopes.			
AtD	Auburn very rocky silt loam, moderately deep, 3 to 31 percent slopes.			
AtE	Auburn very rocky silt loam, moderately deep, 31 to 51 percent slopes.			
AuD	Auburn extremely rocky silt loam, 3 to 31 percent slopes.			
AuF	Auburn extremely rocky silt loam, 31 to 71 percent slopes.			
AvE	Auburn extremely rocky silt loam, moderately deep, 31 to 71 percent slopes.			
CaC	Cohasset loam, 5 to 16 percent slopes.	About 1 foot of cobbly loam and 2 feet of clay loam underlain by about 4 feet of weathered andesitic conglomerate.	0–8	Loam
CaD	Cohasset loam, 16 to 31 percent slopes.		8–39	Clay loam
CbC	Cohasset very cobbly loam, 3 to 16 percent slopes.		39+	Weathered andesitic conglomerate.
CbE	Cohasset very cobbly loam, 16 to 51 percent slopes.			
CbF	Cohasset very cobbly loam, 51 to 71 percent slopes.			
CcC	Cohasset very cobbly loam, moderately deep, 3 to 16 percent slopes.			
CcE	Cohasset very cobbly loam, moderately deep, 16 to 51 percent slopes.			

properties of soils of the Amador Area

Classification—Continued		Permeability	Available water capacity	Reaction	Shrink-swell potential	Remarks
Unified	AASHO					
		Inches per hour	*Inches per inch of soil*	*pH value*		
ML–CL	A–4	0. 8–2. 5	0. 13	5. 7–6. 0	Low.	Geologic erosion active on steep area; a few dikes of quartz and other rocks; in places rock outcrops cover 2 to 15 percent of the surface area; rock fragments within the profile are variable.
ML	A–5(4)	0. 8–2. 5	0. 18	5. 8–6. 3	Low.	Cobblestones 5 to 16 inches in diameter occupy as much as 30 percent of the profile, and their number generally increases with increasing depth; erosion hazard is slight.
MH	A–7–5(14)	0. 2–0. 8	0. 21	4. 8–6. 0	Moderate.	
ML	A–7–5(12)	0. 2–0. 8	0. 21	4. 8–6. 0	Low.	
SM	A–2–4	0. 8–2. 5	0. 13	6. 2–6. 5	Moderate.	In places rock outcrops cover as much as 25 percent of the surface and the soil contains from 15 to 25 percent of rock fragments by volume; at a depth between 10 and 14 inches a lens of hard, broken stone occurs near the upper boundary.
ML–CL	A–4, A–6	<0. 05	0. 17	6. 1–6. 5	Moderate.	
CH	A–7	<0. 05	0. 18	6. 1–6. 5	High.	
ML–CL	A–4(8)	0. 8–2. 5	0. 15	6. 3–6. 5	Moderate.	In places rock outcrops occupy from 5 to 40 percent of the surface; cobblestones and pebbles make up as much as 25 percent of the soil mass in places.
ML–CL	A–4(8)	0. 8–2. 5	0. 17	6. 2–6. 5	Moderate.	
ML	A–4	0. 8–2. 5	0. 17	5. 5–6. 0	Low.	Cobbly soils in the mountainous uplands at an elevation between 2,000 and 3,500 feet.
CL	A–6	0. 5–2. 0	0. 17–0. 21	4. 5–5. 0	Moderate.	

TABLE 5.—*Estimated characteristics and*

Map symbol	Soil	Brief description of soil	Depth from surface	Classification
				USDA texture
			Inches	
CoC	Cohasset very cobbly sandy loam, 3 to 16 percent slopes.	About 2 feet of sandy loam, 1 foot of loam, and 4 feet of clay loam over partly weathered andesitic conglomerate.	0–21	Sandy loam
			21–30	Loam
CoE	Cohasset very cobbly sandy loam, 16 to 51 percent slopes.		30–74	Clay loam
			74–80+	Partly weathered andesitic conglomerate.
EcD	Exchequer very rocky silt loam, 3 to 31 percent slopes.	About 1 foot of silt loam over metabasic rock.	0–6+	Silt loam
EcE	Exchequer very rocky silt loam, 31 to 51 percent slopes.			
FdC	Fiddletown gravelly loam, 9 to 16 percent slopes.	About 1 foot of gravelly loam, which is more gravelly with increasing depth, over weathered schist and slate.	0–10	Gravelly loam
FdD	Fiddletown gravelly loam, 16 to 31 percent slopes.		10–45	Very gravelly loam
			45+	Fractured schist and slate.
FgB	Fiddletown gravelly loam, deep, 3 to 10 percent slopes.			
FoE	Fiddletown very rocky loam, 16 to 51 percent slopes.			
FoF	Fiddletown very rocky loam, 51 to 71 percent slopes.			
FtE	Fiddletown very rocky loam, deep, 16 to 51 percent slopes.			
HaD	Henneke very rocky loam, 3 to 51 percent slopes.	About 1 foot of gravelly loam and clay loam over hard serpentine.	0–4	Gravelly loam
			4–9+	Gravelly clay loam
HcC	Holland coarse sandy loam, 5 to 9 percent slopes.	About 1 foot of coarse sandy loam, 1 foot of heavy coarse sandy loam, 2 feet of coarse sandy clay loam, and 1½ feet of light coarse sandy clay loam over deep, weathered granitic rock.	0–10	Coarse sandy loam
			10–22	Coarse sandy loam
HcD	Holland coarse sandy loam, 9 to 16 percent slopes.		22–49	Coarse sandy clay loam.
HcE	Holland coarse sandy loam, 16 to 36 percent slopes.		49–58	Light coarse sandy loam.
HdC	Holland coarse sandy loam, deep, 5 to 9 percent slopes.		58–70+	Weathered granite
HdD	Holland coarse sandy loam, deep, 9 to 16 percent slopes.			
HfD	Holland very rocky coarse sandy loam, 9 to 16 percent slopes.			
HfE	Holland very rocky coarse sandy loam, 16 to 51 percent slopes.			
HfF	Holland very rocky coarse sandy loam, 51 to 71 percent slopes.			
HkE	Holland very rocky coarse sandy loam, deep, 16 to 51 percent slopes.			
Hm	Honcut clay loam, over clay.	About 2½ feet of very fine sandy loam underlain by 3 feet or more of silt loam; soils consist of stratified alluvium.	0–30	Very fine sandy loam
			30–60+	Silt loam
Hn	Honcut silt loam.			
Ho	Honcut very fine sandy loam.			
Hs	Honcut very fine sandy loam, moderately well drained.			
Hv	Honcut very fine sandy loam, channeled.			
IdC	Inks loam, deep variant, 3 to 16 percent slopes.	About 1 foot of loam, ½ foot of heavy loam, and about 2 feet of clay loam over hard, andesitic sandstone.	0–7	Loam
			7–11	Heavy loam
			11–31+	Clay loam
IsE	Iron Mountain very stony loam, 9 to 51 percent slopes.	About 2 feet of very stony loam underlain by hard, tuffaceous breccia.	0–20+	Very stony loam
IvE	Iron Mountain very stony loam, rhyolite substratum, 9 to 51 percent slopes.			
JgE	Jiggs very rocky loam, 16 to 51 percent slopes.	About 1½ feet of very stony loam over rhyolitic tuff.	0–15	Gravelly loam

properties of soils of the Amador Area—Continued

Classification—Continued		Permeability	Available water capacity	Reaction	Shrink-swell potential	Remarks
Unified	AASHO					
		Inches per hour	*Inches per inch of soil*	*pH value*		
SM	A–2	2. 5–5. 0	0. 10	5. 8–6. 0	Moderate.	Moderately steep to steep, cobbly soils on andesitic ridges at an elevation of more than than 3,500 feet.
ML	A–4	2. 5–5. 0	0. 13	5. 5	Moderate.	
CL	A–6	0. 2–0. 8	0. 15	4. 5–5. 0	Moderate to high.	
SM	A–2	0. 8–2. 5	0. 08–0. 13	6. 0–6. 5	Moderate.	Excessively drained rocky soils that are subject to erosion; about 30 percent of the surface area is rock outcrop.
SM–SC	A–4	0. 8–2. 5	0. 11	6. 2	Low to moderate.	Pebbles and cobblestones make up about 25 percent of the surface layer, and the number of stones increases with increasing depth; subject to erosion if unprotected; bedrock is generally tilted vertically; tends to bulk as bank yardage.
GM	A–1	5. 0–10. 0	0. 067	6. 0–6. 5	Low.	
SM	A–2–4	0. 8–2. 5	0. 05	6. 9	Low.	Geologic erosion is active; gravel makes up as much as 50 percent of the soil mass.
SM, SC	A–2–7	0. 8–2. 5	0. 08	6. 9	Low.	
SM	A–2	2. 5–5. 0	0. 11	6. 3–6. 5	Low.	Soils are well drained and subject to erosion if unprotected; rock outcrops cover 5 to 25 percent of the surface; stone fragments make up as much as 20 percent of the soil; weathered bedrock is suitable for drainage filter material.
SC	A–2–6 or 7	0. 8–2. 5	0. 12	6. 0	Moderate.	
SC	A–2–6	0. 2–0. 8	0. 15	5. 8–6. 0	Low to moderate.	
SC	A–2–6	0. 8–2. 5	0. 13	5. 6	Low.	
SM	A–2	0. 8–2. 5	0. 13	6. 5–7. 0	Low.	Soils are well drained to moderately well drained and contain mining debris and creek overwash in places; water table is generally at a depth of more than 5 feet; gullied in places; layers of sand and gravel 3 to 14 inches thick in places.
SM–ML	A–2, A–4	0. 2–0. 8	0. 11	7. 0–7. 5	Low.	
SC	A–2–6	0. 8–2. 5	0. 13	6. 0–6. 3	Low.	Soils are well drained and contain hard, andesitic sandstone at a depth between 20 and 36 inches; in some areas there are cobblestones or pebbles on the surface.
ML	A–4	0. 8–2. 5	0. 14	6. 0	Low.	
ML–CL	A–4, A–6	0. 2–0. 8	0. 15	6. 0	Low.	
GM	A–2	0. 8–2. 5	0. 10	5. 3–5. 8	Low.	Soils are well drained to excessively drained and subject to erosion if unprotected; pebbles and cobblestones make up as much as 50 percent of the soil mass; tends to bulk as bank yardage.
SM–SC	A–4	0. 8–2. 5	0. 13	6. 3	Low.	Soils are well drained and subject to slight erosion; in places as much as 40 percent of the soil mass consists of rocks and cobblestones; bedrock is white and gray.

TABLE 5.—*Estimated characteristics and*

Map symbol	Soil	Brief description of soil	Depth from surface	Classification
				USDA texture
			Inches	
JmC	Josephine loam, 3 to 16 percent slopes.	About 1 foot of gravelly loam and 3 feet of silty clay loam over decomposed schist.	0–9	Gravelly loam
JmD	Josephine loam, 16 to 31 percent slopes.		9–37	Gravelly silty clay loam.
JmE	Josephine loam, 31 to 51 percent slopes.			
JnC	Josephine loam, deep, 9 to 16 percent slopes.		37–47	Silty clay loam
JnD	Josephine loam, deep, 16 to 31 percent slopes.		47–68+	Decomposed schist
JnE	Josephine loam, deep, 31 to 51 percent slopes.			
JoC	Josephine very rocky loam, 3 to 16 percent slopes.			
JoE	Josephine very rocky loam, 16 to 51 percent slopes.			
JoF	Josephine very rocky loam, 51 to 71 percent slopes.			
JpE	Josephine very rocky loam, deep, 16 to 51 percent slopes.			
JpF	Josephine very rocky loam, deep, 51 to 71 percent slopes.			
LaC	Laniger sandy loam, 2 to 16 percent slopes.	About 2 feet of sandy loam over hard, rhyolitic tuff.	0–28	Sandy loam
LgB	Laniger sandy loam, thick surface, 0 to 5 percent slopes.		28+	Hard rhyolitic tuff
Ln	Limestone rock land.	A very thin mantle of loam between outcrops of recrystallized limestone and marble; source of material used in the manufacture of Portland cement.		
Lo	Loamy alluvial land.	Small areas of recent alluvial deposits adjacent to stream channels; subject to flooding; the soil material is similar to the Honcut soils.		
Ma	Made land.	Dredger diggings refilled with soil material from basic schist, slate, and alluvium from various sources; soil material is stratified.		
MbD	Mariposa gravelly loam, 3 to 31 percent slopes.	About 2 feet of silt loam over decomposed schist.	0–4	Gravelly loam
McD	Mariposa very rocky loam, 9 to 31 percent slopes.		4–15	Gravelly silty clay loam.
McE	Mariposa very rocky loam, 31 to 51 percent slopes.		15–23	Silt loam
McF	Mariposa very rocky loam, 51 to 85 percent slopes.		23–36	Decomposed schist
MgE	Maymen very rocky loam, 9 to 51 percent slopes.	About 1 foot of rocky loam over bedrock of tilted slate.	0–7	Rocky loam
MkE	McCarthy very rocky loam, 16 to 51 percent slopes.	About 3 feet of very rocky loam and 1 foot of cobbly loam over weathered breccia conglomerate.	0–31	Very cobbly loam
MkF	McCarthy very rocky loam, 51 to 71 percent slopes.		31+	Weathered conglomerate.
MlC	McCarthy very cobbly loam, 3 to 16 percent slopes.			
MmE	McCarthy and Jiggs very cobbly loams, 16 to 51 percent slopes.			
Mn	Mine tailings and Riverwash.	Very stony and cobbly material in beds of rivers and creeks, in areas that have been placer mined, and in mine dumps; subject to flooding in periods of high water; source of construction material.		
Mo	Mixed alluvial land.	Unclassified alluvial soils from mixed sources in narrow stringers adjacent to stream channels; soil material is highly stratified and variable throughout.		
Mp	Mixed wet alluvial land.			

properties of soils of the Amador Area—Continued

Classification—Continued		Permeability	Available water capacity	Reaction	Shrink-swell potential	Remarks
Unified	AASHO					
		Inches per hour	*Inches per inch of soil*	*pH value*		
ML	A-4(6)	0. 8–2. 5	0. 15	6. 0–6. 5	Low.	Soils are well drained and subject to erosion if unprotected; slaty rock fragments are generally in the profile or rock outcrops on the surface.
ML	A-7-5(11)	0. 2–0. 8	0. 18	5. 3	Low.	
ML	A-7-5(10)	0. 2–0. 8	0. 17	4. 9	Moderate.	
SM	A-4	2. 5–5. 0	0. 13	5. 1–5. 5	Low.	Soils are in swales; in places there is a layer of clay just above hard, rhyolitic tuff.
ML	A-4	0. 8–2. 5	0. 14	6. 0	Low.	Soils are well drained and subject to slight erosion if unprotected; as much as 25 percent of the soil mass consists of pebbles and cobblestones; rock outcrops are common.
ML-CL	A-4, A-6	0. 8–2. 5	0. 16	5. 5	Low.	
ML	A-4	0. 8–2. 5	0. 14	5. 5	Low.	
ML-CL	A-4, A-6	0. 8–2. 5	0. 14	6. 0	Low.	Depth to bedrock ranges from 2 to 10 inches; rock outcrops are common; slaty rock fragments make up as much as 30 percent of the soil in places.
GM	A-2	0. 8–2. 5	0. 18	6. 0	Low.	Soils are well drained; scattered outcroppings of cemented conglomerate; at a depth of 21 to 31 inches; about 40 percent of the soil material consists of cobblestones.

TABLE 5.—*Estimated characteristics and*

Map symbol	Soil	Brief description of soil	Depth from surface	Classification
				USDA texture
			Inches	
MrB	Mokelumne sandy loam, 2 to 5 percent slopes.	About 1 foot of sandy loam, 1 foot of sandy clay, and 2 feet of coarse sandy clay loam over old sandstone or clayey marine deposits.	0–13	Sandy loam
MsD	Mokelumne coarse sandy loam, 5 to 36 percent slopes.		13–22	Sandy clay
			22–52+	Coarse sandy clay loam.
MuB	Musick sandy loam, 3 to 9 percent slopes.	About 2 feet of sandy loam, 2 feet of clay loam, and 4 feet of sandy loam over weathered granitic rock.	0–14	Sandy loam
MuC	Musick sandy loam, 9 to 16 percent slopes.		14–23	Heavy loam
MuD	Musick sandy loam, 16 to 31 percent slopes.		23–47	Heavy clay loam
MuE	Musick sandy loam, 31 to 51 percent slopes.		47–97	Fine sandy loam
MvC	Musick very rocky sandy loam, 9 to 16 percent slopes.		97+	Weathered granitic rock.
MvE	Musick very rocky sandy loam, 16 to 51 percent slopes.			
MvF	Musick very rocky sandy loam, 51 to 71 percent slopes.			
MwE	Musick very rocky sandy loam, moderately deep, 16 to 51 percent slopes.			
MwF	Musick very rocky sandy loam, moderately deep, 51 to 71 percent slopes.			
MxF	Musick extremely rocky sandy loam, moderately deep, 51 to 71 percent slopes.			
PaD	Pardee cobbly loam, 3 to 31 percent slopes.	About 1 foot of gravelly loam and 1 foot of cobbly gravelly clay loam over weathered, andesitic conglomerate.	0–9	Gravelly loam
			9–18	Cobbly gravelly clay loam.
			18–41+	Weathered, andesitic conglomerate.
PnC	Pentz sandy loam, 2 to 16 percent slopes.	About 1½ feet of sandy loam over hard, volcanic tuff.	0–20	Sandy loam
PnC2	Pentz sandy loam, 9 to 16 percent slopes, eroded.		20+	Hard volcanic tuff
PnD	Pentz sandy loam, 16 to 31 percent slopes.			
PoE	Pentz sandy loam, very shallow, 2 to 51 percent slopes.			
PpC	Pentz gravelly sandy loam, 2 to 16 percent slopes.			
PrA	Perkins loam, 0 to 3 percent slopes.	About 1 foot of loam, 1 foot of gravelly loam, 1½ feet of gravelly clay loam over old, consolidated gravelly alluvium.	0–8	Loam
PrC	Perkins loam, 3 to 16 percent slopes.		8–23	Gravelly loam
			23–40	Gravelly clay loam
			40+	Cemented gravelly sandstone.
PtB	Peters clay, 3 to 9 percent slopes.	About 4 feet of clay over weathered, andesitic tuff.	0–43	Clay
Pw	Placer diggings and Riverwash.	Stony, cobbly, and gravelly material in beds of streams and creeks and fines from stamp mills or placer diggings that have settled behind debris dams; subject to frequent flooding; source of construction materials.		
Ro	Rock land.	Extremely rocky, stony, cobbly land on uplands; bedrock is granodiorite, andesite, conglomerate, breccia, and metamorphosed sedimentary and basic rocks; rock outcrops cover from 40 to 90 percent of the surface; material is excessively drained; runoff is rapid.		
RyA	Ryer silty clay loam, 0 to 3 percent slopes.	About 1½ feet of light silty clay loam underlain by 3 feet or more of heavy silty clay loam alluvium.	0–13	Light silty clay loam
			13–18	Silty clay loam
			18–39	Heavy silty clay loam
			39–56+	Silty clay loam

properties of soils of the Amador Area—Continued

Classification—Continued		Permeability	Available water capacity	Reaction	Shrink-swell potential	Remarks
Unified	AASHO					
		Inches per hour	*Inches per inch of soil*	*pH value*		
SM	A-2	2.5–5.0	0.06	4.5–5.0	Low.	Soils are moderately well drained and very susceptible to erosion; underlain by the Ione formation.
SC	A-2-6	0.05–0.2	0.10	4.8–5.0	Low.	
SC	A-2-6, A-4	<0.05	0.14	4.5	Low.	
ML or SM-SC	A-4	0.8–2.5	0.11	6.0	Low.	Soils are well drained and subject to erosion if unprotected; in places 5 to 10 percent of the surface area consists of rock outcrops.
ML	A-4	0.8–2.5	0.14	5.7	Low.	
ML or SM	A-7-5	0.2–0.8	0.18	5.5	Low.	
SM	A-5 (3)	0.2–0.8	0.16	5.4–5.6	Low.	
SM-SC	A-2-4	0.8–2.5	0.11	6.1–6.3	Moderate.	Soils are well drained; in places cobblestones and pebbles make up 30 to 60 percent of the soil mass, by volume, and are common on the surface; tend to bulk as bank yardage.
GC	A-2-6 or 7	0.2–0.8	0.15	5.3–6.0	Low.	
SM	A-4	2.5–5.0	0.08	5.1–5.5	Low.	Horizontally bedded rock outcrops of volcanic tuff are common.
ML	A-4	0.8–2.5	0.15	5.6–6.0	Low.	Soils are well drained; in places cobblestones and pebbles make up 15 to 25 percent of the soil mass, by volume, and are common on the surface.
GC-CL	A-2-6 or 7	0.8–2.5	0.16	5.6–6.0	Moderate.	
GC	A-2-6 or 7	0.2–0.8	0.18	5.6–6.0	Moderate.	
CH	A-7	<0.05	0.16	5.5–7.0	High.	Soils are moderately well drained to somewhat poorly drained; surface cracks when dry; montmorillonite apparent in some places.
						Can be used for riprapping material.
ML	A-4	0.8–2.5	0.15	6.0	Low.	Soils are well drained; the horizons below a depth of 18 inches are very compact and dense.
ML	A-4	0.2–0.8	0.16	5.8	Low.	
ML-CL	A-4, A-6	0.05–0.2	0.18	6.8–7.5	Low.	
ML	A-4	0.05–0.2	0.16	7.0–7.5	Low.	

TABLE 5.—*Estimated characteristics and*

Map symbol	Soil	Brief description of soil	Depth from surface	Classification
				USDA texture
			Inches	
Sa	Sedimentary rock land.	A thin mantle of mixed gravelly soil and exposed sandstone and clay of the Ione formation; source of material used in the manufacture of clay and glass products.		
Sb	Serpentine rock land.	A very shallow mantle of gravelly soil material and extremely rocky, gravelly material over serpentine rock; rock outcrops cover from 50 to 90 percent of the surface.		
ScF	Shaver very rocky coarse sandy loam, 51 to 71 percent slopes.	About 5 feet of coarse sandy loam over decomposed granitic rock.	0–65+	Coarse sandy loam
SdF	Shaver very rocky coarse sandy loam, moderately deep, 51 to 71 percent slopes.			
SfB	Shenandoah loam, 3 to 9 percent slopes.	About 2 feet of loam, 1 foot of clay, and 1 foot of sandy loam over weathered granitic rock.	0–6 6–24 24–32 32–40 40–46+	Loam Loam Clay Sandy loam Weathered granitic rock.
SgB	Sierra coarse sandy loam, 3 to 9 percent slopes.	About 1 foot of coarse sandy loam and 4 feet of clay loam over deeply weathered, granitic rock.	0–15 15–66 66–73	Sandy loam Clay loam Sandy loam
SgB2	Sierra coarse sandy loam, 3 to 9 percent slopes, eroded.			
SgC	Sierra coarse sandy loam, 9 to 16 percent slopes.			
SgC2	Sierra coarse sandy loam, 9 to 16 percent slopes, eroded.			
SgD	Sierra coarse sandy loam, 16 to 31 percent slopes.			
SgD2	Sierra coarse sandy loam, 16 to 31 percent slopes, eroded.			
ShB	Sierra coarse sandy loam, moderately deep, 3 to 9 percent slopes.			
ShB2	Sierra coarse sandy loam, moderately deep, 3 to 9 percent slopes, eroded.			
ShC	Sierra coarse sandy loam, moderately deep, 9 to 16 percent slopes.			
ShC2	Sierra coarse sandy loam, moderately deep, 9 to 16 percent slopes, eroded.			
ShD	Sierra coarse sandy loam, moderately deep, 16 to 31 percent slopes.			
ShD2	Sierra coarse sandy loam, moderately deep, 16 to 31 percent slopes, eroded.			
SkD	Sierra very rocky coarse sandy loam, 16 to 31 percent slopes.			
SkF	Sierra very rocky coarse sandy loam, 51 to 71 percent slopes.			
SlD3	Sierra sandy clay loam, 9 to 31 percent slopes, severely eroded.			
SmD	Sierra very rocky coarse sandy loam, moderately deep, 9 to 31 percent slopes.			
SmE	Sierra very rocky coarse sandy loam, moderately deep, 31 to 51 percent slopes.			

properties of soils of the Amador Area—Continued

Classification—Continued		Permeability	Available water capacity	Reaction	Shrink-swell potential	Remarks
Unified	AASHO	*Inches per hour*	*Inches per inch of soil*	*pH value*		
SM	A–2	2. 5–5. 0	0. 11	6. 0	Moderate.	Soils are well drained to somewhat excessively drained; erosion hazard is high; in places rock outcrops occupy from 10 to 25 percent of the surface area; suitable for drainage filter material.
ML	A–4	0. 8–2. 5	0. 13	6. 0	Low.	Soils are somewhat poorly drained to moderately well drained; susceptible to erosion if unprotected.
ML	A–4	0. 8–2. 5	0. 14	5. 0–5. 8	Low.	
CL	A–6	0. 05–0. 2	0. 18	5. 8	Moderate.	
SM	A–2–4	0. 05–0. 2	0. 16	6. 0	Low.	
SM–SC	A–4(2)	0. 8–2. 5	0. 15	6. 0	Low.	Soils are well drained; very susceptible to erosion if unprotected; in some places there are rock outcrops; rills and gullying are evident in some areas.
ML–CL	A–7–6(10)	0. 2–0. 8	0. 18	6. 0–6. 5	Low.	
ML	A–4(4)	0. 2–0. 8	0. 18	6. 0	Low.	

TABLE 5.—*Estimated characteristics and*

Map symbol	Soil	Brief description of soil	Depth from surface	Classification
				USDA texture
			Inches	
SnB	Sites loam, 3 to 9 percent slopes.	About 1 foot of loam and 4 feet of gravelly clay over weathered slate and schist.	0–8	Loam
SnC	Sites loam, 9 to 16 percent slopes.		8–15	Heavy loam
SnD	Sites loam, 16 to 31 percent slopes.		15–35	Clay loam
SnE	Sites loam, 31 to 51 percent slopes.		35–67	Clay
SoC	Sites loam, moderately deep, 3 to 16 percent slopes.		67–72	Loam
SoD	Sites loam, moderately deep, 16 to 31 percent slopes.		72+	Weathered schist
SoE	Sites loam, moderately deep, 31 to 51 percent slopes.			
SpD3	Sites clay loam, moderately deep, 3 to 31 percent slopes, severely eroded.			
SrC	Sites very rocky loam, 3 to 16 percent slopes.			
SrE	Sites very rocky loam, 16 to 51 percent slopes.			
SrF	Sites very rocky loam, 51 to 85 percent slopes.			
SsE	Sites very rocky loam, moderately deep, 16 to 51 percent slopes.			
SuB	Snelling loam, moderately well drained, 0 to 9 percent slopes.	About 2 feet of sandy loam and 1 foot of sandy clay loam over stratified, granitic alluvium.	0–16	Sandy loam
SvA	Snelling fine sandy loam, 0 to 2 percent slopes.		16–24	Heavy sandy loam
SvB	Snelling fine sandy loam, 2 to 5 percent slopes.		24–36+	Sandy clay loam
SvC	Snelling fine sandy loam, 5 to 9 percent slopes.			
SwD	Snelling sandy loam, 9 to 16 percent slopes.			
SwE	Snelling sandy loam, 16 to 31 percent slopes.			
SxD	Supan cobbly loam, 3 to 31 percent slopes.	About 1 foot of cobbly loam and about 5 feet of cobbly clay loam over weathered volcanic conglomerate.	0–8	Cobbly loam
SyD	Supan very cobbly loam, moderately deep, 3 to 31 percent slopes.		8–16	Cobbly clay loam
SyE	Supan very cobbly loam, moderately deep, 31 to 51 percent slopes.		16–38	Cobbly gravelly clay loam.
			38–58	Cobbly sandy clay loam.
			58–70	Cobbly gravelly loam
			70–75+	Weathered conglomerate.
TcE	Tiger Creek very rocky loam, 16 to 51 percent slopes.	About 1 foot of very rocky loam and 1 foot of very rocky clay loam over recrystallized limestone.	0–15	Very rocky loam
			15–26	Very rocky clay loam
WcD	Windy cobbly sandy loam, 9 to 16 percent slopes.	About 4 feet of cobbly fine sandy loam underlain by partly weathered, volcanic breccia or conglomerate.	0–49+	Cobbly fine sandy loam
WcE	Windy cobbly sandy loam, 16 to 51 percent slopes.			

Engineering interpretations of the characteristics and qualities of the soils of each series are given in table 6. Factors that affect location of highways in the Area and location of farm ponds and reservoirs are described in the first three columns. Then the hydrologic soil group is given.

Engineers and soil scientists of the Soil Conservation Service have classified the major soil series into four hydrologic groups. The grouping is based on data and estimates of the intake of water during the latter part of a storm of long duration, after the soil profile is wet and has an opportunity to swell, without the protective effect of any vegetation. The grouping is tentative and subject to change as further data and experience are gained. The four groups are:

A. Soils that have a high infiltration rate even when thoroughly wetted; primarily deep, well-drained to somewhat excessively drained, moderately coarse textured soils or medium-textured soils with abundant rock fragments. These soils have a high rate of water transmissoin.

B. Soils that have an above-average infiltration rate when thoroughly wetted; primarily moderately deep to deep, moderately well drained or well drained soils of moderately fine to moderately coarse texture. These soils have a moderate rate of water transmission.

C. Soils that have a below-average infiltration rate when thoroughly wetted; primarily soils that contain a layer that impedes the downward movement of water, or soils of moderately fine texture that have a slow

properties of soils of the Amador Area—Continued

Classification—Continued		Permeability	Available water capacity	Reaction	Shrink-swell potential	Remarks
Unified	AASHO					
		Inches per hour	*Inches per inch of soil*	*pH value*		
ML	A-4(5)	0. 8–2. 5	0. 18	6. 3	Low.	Soils are well drained; susceptible to erosion if unprotected; rock outcrops occupy as much as 25 percent of the surface; slaty rock fragments make up 5 to 35 percent of the soil mass, by volume; the bedrock is tilted nearly vertical.
ML-CL	A-4(6)	0. 8–2. 5	0. 18	6. 3	Low.	
ML-CL	A-7-4(6)	0. 2–0. 8	0. 22	6. 3	Low.	
CL	A-7-6(12)	0. 2–0. 8	0. 22	6. 0–6. 2	Moderate.	
ML	A-4(7)	0. 2–0. 8	0. 22	6. 0–6. 2	Low.	
SM	A-2	2. 5–5. 0	0. 075	6. 5	Low.	Soils are well drained and susceptible to erosion if unprotected; they are micaceous and high in quartz minerals.
ML	A-4	0. 8–2. 5	0. 09	6. 3	Moderate.	
ML-CL	A-4, A-6	0. 2–0. 8	0. 13	6. 3	Low.	
GM	A-2	0. 8–2. 5	0. 14	6. 3	Low.	Soils are well drained and stable; in places 30 to 50 percent of the soil mass consists of cobblestones and other rounded stones.
GC	A-2-6 or 7	0. 8–2. 5	0. 16	6. 5	Moderate.	
GC	A-2-6 or 7	0. 2–0. 8	0. 09	6. 8	Low.	
GC	A-2-6 or 7	0. 2–0. 8	0. 13	7. 5	Low.	
GC	A-2-6 or 7	0. 2–0. 8	0. 10	7. 2	Low.	
SC	A-2-6 or 7	0. 8–2. 5	0. 13	7. 5	Low.	Soils are well drained and susceptible to erosion if unprotected; stones in the profile, chiefly of marble, range from 10 to 90 percent of the volume and their number increases with increasing depth.
GC	A-2-6 or 7	0. 2–0. 8	0. 18	7. 5	Low.	
SM-GM	A-2	2. 5–5. 0	0. 08	5. 8–6. 0	Low.	Soils are excessively drained to well drained; in places as much as 30 percent of the soil mass consists of rounded cobblestones 1 to 6 inches in diameter or consists of 50 percent of pebbles.

infiltration rate, or soils underlain by bedrock. These soils have a slow rate of water transmission.

D. Soils that have a very slow infiltration rate when thoroughly wetted; primarily (1) soils that have very slow internal drainage, (2) soils that have a claypan or a clay layer at or near the surface, and (3) shallow soils over nearly impervious materials. These soils have a very slow rate of water transmission.

Depth to bedrock is of interest to the engineer. Generally, the soils are shallow to underlying bedrock in the western part of the Amador Area and increasingly deeper to the east.

At the higher elevations in the eastern part of the Area are deep, granitic soils that are highly susceptible to erosion when exposed on embankment faces and cut slopes. At the lower elevations in the western part of the Area, soils that are shallow over firm bedrock present problems in constructing roadways and laying pipelines. In these areas the construction and operation of septic tanks and of beds for the disposal of effluent is also complicated by the nearness of bedrock to the surface. On the steeply sloping, rocky ridges, separated by narrow and deeply incised stream channels, location of good roadways is difficult. Because of the numerous outcrops of tilted and fractured slate and schist, dam foundations and reservoirs may require special treatment to prevent excessive seepage.

Flooding is a problem in some areas. Streams that flow into the Ione and Jackson Valleys, where the channel gradient is much reduced, are subject to overflow. Correction of the channel is necessary to prevent such floods.

TABLE 6.—*Engineering interpretations of soils in the Amador Area, Calif.*

Soils series and map symbols	Soil features affecting engineering practices—		
	Road location	Farm ponds and reservoirs	
		Reservoir area	Embankments
Ahwahnee (AaB, AaB2, AaC, AaC2, AaD, AaD2, AdD, AdD3, AdE, AeE, AfD).	Gently rolling to steep soils in hilly and mountainous areas with exposures of bedrock; the underlying granitic rock is deeply weathered and highly fractured.	High seepage rate; the underlying granitic rock is weathered and fractured and fairly porous.	Susceptible to piping, particularly when the plasticity index is less than 6, and susceptible to settlement cracking; the erosion hazard is high on embankments; moisture-density control is important.
Aiken (AhB, AhC, AkC, AkD, AkE, AmE, AmF).	Gently sloping to very steep soils that are poorly drained.	Moderate seepage rate	Low resistance to settlement cracking and susceptible to piping; moisture-density control is important.
Argonaut (AnD, AoD)	Undulating to hilly soils that are poorly drained; many outcrops of meta-andesite.	Low seepage rate	High resistance to piping, low susceptibility to settlement cracking, and high potential for post-construction settlement.
Auburn (ApD, ArC, ArD, AsB2, AsD, AsE, AtD, AtE, AuD, AuF, AvE).	Nearly level to very steep soils that are well drained; many outcrops of amphibolite schist on the steeper slopes; shallow to bedrock.	Variable seepage rate, depending on the degree of shattering in the parent material.	Low resistance to piping, particularly when the plasticity index is less than 6, and crack readily on settling; moisture-density control is important.
Cohasset (CaC, CaD, CbC, CbE, CbF, CcC, CcE, CoE).	Gently rolling to very steep very cobbly loams and very cobbly sandy loams and moderately steep to steep loams in mountainous areas; road cuts in the loams are very susceptible to erosion.	Moderate seepage rate; substratum of the very cobbly sandy loams is generally cemented.	In the loams and very cobbly loams, resistance to piping is intermediate and susceptibility to settlement cracking is moderate; in the very cobbly sandy loams, resistance to piping is intermediate, susceptibility to settlement cracking is high if plasticity index is less than 15, and moisture-density control is important.
Exchequer (EcD, EcE).	Undulating to steep soils that are only about 1 foot thick over bedrock; rock outcrops make up as much as 50 percent of the surface area.	Variable seepage loss, depending on the shattering of the parent material.	Low to intermediate resistance to piping; susceptible to settlement cracking; a high seepage rate; moisture-density control is important.
Fiddletown, (FdC, FdD, FgB, FoE, FoF, FtE).	Gently rolling to very steep soils in mountainous areas; road cuts are very susceptible to erosion.	High seepage loss; underlying material is fairly porous and bedrock is fractured.	Low resistance to piping and susceptible to settlement cracking; moisture-density control is important.
Henneke (HaD)	Rolling to hilly soil with many rock outcrops.	Very low seepage rate; bedrock is massive and hard.	Intermediate resistance to piping; susceptible to settlement cracking.
Holland (HcC, HcD, HcE, HdC, HdD, HfD, HfE, HfF, HkE).	Moderately sloping to very steep soils in mountainous areas; the underlying granitic rock is deeply weathered; road cuts are very susceptible to erosion.	High seepage rate; underlying granitic rock is fairly porous.	Low resistance to piping; moderate resistance to settlement cracking.

Honcut (Hm, Hn, Ho, Hs, Hv).	Level to gently sloping soils in alluvial fans and on flood plains; some areas require drainage.	Moderate to high seepage rate, depending on stratification in substratum.	High susceptibility to settlement cracking and intermediate resistance to piping where the plasticity index is less than 15; moisture-density control is important.
Inks (IdC)	Gently sloping to rolling soil in hilly areas; the underlying bedrock is hard andesitic sandstone.	Low seepage rate	Low resistance to piping where plasticity index is less than 6, and high susceptibility to settlement cracking; moisture-density control is important.
Iron Mountain (IsE, IvE).	Moderately sloping to moderately steep soils in mountainous areas with outcroppings of cemented conglomerate.	Surface layer is porous, but the bedrock is impervious and has low seepage rate; soils normally are only on ridges.	Low to intermediate resistance to piping and intermediate susceptibility to settlement cracking; moisture-density control is important.
Jiggs (JgE)	Rolling to steep soils in mountainous areas; many rock outcrops.	High seepage loss; not suitable for reservoir sites; underlying material is porous and fractured.	Moderate resistance to piping; moderate susceptibility to settlement cracking.
Josephine (JmC, JmD, JmE, JnC, JnD, JnE, JoC, JoE, JoF, JpE, JpF).	Undulating to steep soils in mountainous areas; in some places there are rock outcrops of slate; road cuts are susceptible to erosion; drainageways should be provided.	Variable seepage rate because of fractured, vertical bedrock.	Intermediate resistance to piping and high susceptibility to settlement cracking where the plasticity index is less than 15; moisture-density control is important.
Laniger (LaC, LgB)	Undulating to rolling and very steep soils that are well drained; bedrock is exposed on most slopes.	Low seepage rate caused by hard, cemented layers in the subsurface.	Low to intermediate resistance to piping and susceptible to settlement cracking; moisture-density control is important.
Limestone rock land (Ln).	A very thin mantle of loam between rock outcrops of limestone and marble of the Calaveras formation that cover 50 to 90 percent of the surface.	Unsuitable; slope ranges from 9 to 51 percent.	----------
Loamy alluvial land (Lo).	Nearly level to gently rolling land made up of small, recent, alluvial deposits adjacent to stream channels; generally at an elevation of more than 1,500 feet.	High seepage rate because the underlying material is porous.	----------
Made land (Ma)	Placer mined areas in narrow valley bottoms, which have been excavated, refilled, and rough leveled; some areas are hummocky.	High seepage rate because the underlying material is porous.	----------
Mariposa (MbD, McD, McE, McF).	Gently rolling to very steep soils that are only 2 feet deep over decomposed schist; rock outcrops are common on the steeper slopes.	Variable seepage rate because of gravel within the profile and vertically tilted bedrock.	Low resistance to piping and high susceptibility to settlement cracking; moisture-density control is important.
Maymen (MgE)	Hilly to steep soils in mountainous areas that are only about 10 inches deep over hard, tilted slate rock; rock outcrops are common.	Variable seepage rate because bedrock is tilted nearly vertical.	High susceptibility to settlement cracking and intermediate resistance to piping when plasticity index is less than 15; moisture-density control is important.
McCarthy (MkE, MkF, MlC).	Gently sloping to very steep soils on uplands; numerous cobblestones and rock outcrops are on the surface; susceptible to erosion.	Moderate seepage rate even though material is cobbly; bedrock is tuffaceous.	Low resistance to piping and intermediate susceptibility to settlement cracking; moisture-density control is important.

TABLE 6.—*Engineering interpretations of soils in the Amador Area, Calif.*—Continued

Soils series and map symbols	Soil features affecting engineering practices—		
	Road location	Farm ponds and reservoirs	
		Reservoir area	Embankments
Mine tailings and Riverwash (Mn).	Very stony and cobbly material in beds of rivers and creeks; placer-mined areas and mine dumps are mostly in stream channels that flow from east to west throughout the Area.	High seepage rate	
Mixed alluvial land (Mo, Mp).	Unclassified alluvial soils from mixed sources in areas adjacent to stream channels; older alluvial terraces and meadow lands are also included; may be necessary to provide drainage and construct waterways; susceptible to erosion.	High seepage rate; underlying materials should be investigated to determine seepage rate.	Subject to piping and settlement cracking; moisture-density control is important.
Mokelumne (MrB, MsD).	Gently rolling to hilly soils on dissected terraces; susceptible to erosion; drainage required in places.	Low seepage rate because of tight, clayey bedrock.	Intermediate resistance to piping and settlement cracking.
Musick (MuB, MuC, MuD, MuE, MvC, MvE, MvF, MwE, MwF, MxF).	Deep, gently sloping to very steep soils of granitic origin in mountainous areas; susceptible to erosion; in places rock outcrops cover as much as 10 percent of the surface.	High seepage rate; underlying granite is deeply weathered, fractured, and porous.	Subject to piping, particularly if the plasticity index is less than 6, and cracks readily on settling; erosion hazard is high on embankments; moisture-density control is important.
Pardee (PaD)	Undulating to rolling soils on slightly elevated terraces above the valley floors; quartz cobblestones and pebbles make up as much as 60 percent of the soil mass in places; montmorillonite in the subsoil.	Low to moderate seepage rate, depending on the underlying clay and cemented gravel.	Intermediate resistance to piping and high resistance to settlement cracking.
Pentz (PnC, PnC2, PnD, PoE, PpC).	Undulating to rolling and very steep soils that are well drained; bedrock is exposed on most slopes.	Low seepage rate caused by hard, cemented layers in the subsurface.	Low to intermediate resistance to piping and susceptible to settlement cracking; moisture-density control is important.
Perkins (PrA, PrC)	Undulating to rolling soils on slightly elevated terraces above the valley floors; quartz pebbles and cobblestones make up as much as 30 percent of the soil mass.	Low to moderate seepage rate, depending on the underlying clay and cemented gravel.	Intermediate resistance to piping and high resistance to settlement cracking.
Peters (PtB)	Gently sloping soils; may be necessary to provide drainage and construct waterways; upper 4 feet contains plastic clay material.	Low seepage rate; underlying material consists of clay over hard, andesitic tuff.	High post-construction settlement and high deformability; not likely to pipe or crack on settling.
Placer Diggings and Riverwash (Pw).	Poorly sorted, stratified, stony and cobbly material derived from mining and that is in stream beds and behind debris dams; in places may be necessary to provide drainage and construct waterways; slope ranges from 0 to 51 percent.	High seepage rate	Subject to piping and cracking; moisture-density control is important; if used for embankments other than reservoirs, select material carefully.

Rock land (Ro)	Extremely rocky and stony mountainous land; most areas are at a high elevation and have slopes of more than 51 percent; but some areas are at lower elevations, generally on rocky, flat tabletop ridges.	High seepage rate if the underlying material is vertically tilted and fractured.	
Ryer (RyA)	Level or nearly level soil on low terraces, which are slightly hummocky and have faint traces of old channels; may be necessary to provide drainage and construct waterways.	Low seepage rate; subsoil is dense and not easily penetrated by moisture.	High resistance to settlement cracking if plasticity index is more than 15; low resistance to piping; moisture-density control is important.
Sedimentary rock land (Sa).	Undulating to steep land made up of a thin mantle of mixed gravelly soil material over sandstone and clay of the Ione formation; may be necessary to provide drainage and construct waterways; susceptible to erosion.	Low to moderate seepage rate, depending on the underlying material.	Subject to settlement cracking and piping.
Serpentine rock land (Sb).	Strongly sloping to steep, extremely rocky and gravelly soil between numerous rock outcrops in hilly to mountainous areas; underlain by serpentine rock.	High seepage rate	
Shaver (ScF, SdF)	Steep soils of granitic origin in mountainous areas; highly susceptible to erosion.	High seepage loss because underlying material is very porous.	Subject to piping, particularly if the plasticity index is less than 6, and cracks readily on settling; moisture-density control is important; fill banks should be protected from erosion.
Shenandoah (SfB)	Gently sloping soil in concave slopes; susceptible to erosion; may be necessary to provide drainage and construct waterways.	If the subsoil is left undisturbed, seepage loss is low.	Intermediate resistance to piping and high susceptibility to settlement cracking if plasticity index is less than 15; moisture-density control is important; erosion control is needed.
Sierra (SgB, SgB2, SgC, SgC2, SgD, SgD2, ShB, ShB2, ShC, ShC2, ShD, ShD2, SkD, SkF, SlD3, SmD, SmE).	Undulating to very steep soils in a transistional zone between hilly and mountainous areas; bedrock is deeply weathered granitic material and is susceptible to erosion; a few rock outcrops scattered in some areas.	High seepage loss because the underlying material is coarse textured and porous.	Subject to piping if the plasticity index is less than 6 and cracks readily on settling; moisture-density control is important; fill banks should be protected from erosion.
Sites (SnB, SnC, SnD, SnE, SoC, SoD, SoE, SpD3, SrC, SrE, SrF, SsE, StE).	Deep, undulating to very steep soils in mountainous areas; subject to erosion; bedrock is weathered, vertically tilted, and depth to it changes frequently; in many places there are numerous rock fragments in the profile.	Variable seepage loss because the bedrock is fractured and vertically tilted.	Material has high resistance to piping; susceptibility to settlement cracking is low; the post-construction settlement potential is high.
Snelling (SuB, SvA, SvB, SvC, SwD, SwE).	Nearly level to hilly soils on terraces, which are remnant deposits of former rivers; underlying materials are stratified sediments; soils are high in quartz and susceptible to erosion.	High to moderate seepage loss; in some places the soils are underlain by strongly cemented siltstone and sandstone.	Low resistance to piping and settlement cracking; moisture-density control is important.

TABLE 6.—*Engineering interpretations of soils in the Amador Area, Calif.*—Continued

Soils series and map symbols	Soil features affecting engineering practices—		
	Road location	Farm ponds and reservoirs	
		Reservoir area	Embankments
Supan (SxD, SyD, SyE).	Undulating to hilly cobbly loam and undulating to steep very cobbly loams; in places as much as 50 percent of the volume of the cobbly loam consists of cobblestones and other rounded stones; the very cobbly loams formed in material from fluvial deposits, contain many cobblestones and other stones, and vary greatly in depth.	Seepage rate is low in the cobbly loam; it is moderate to low in the very cobbly loams, depending on the underlying parent material.	High resistance to piping and settlement cracking.
Tiger Creek (TcE)----	Strongly sloping to very steep soils in mountainous areas; very rocky and highly susceptible to erosion.	High seepage loss because the underlying material is porous.	Highly susceptible to piping and settlement cracking, particularly if the plasticity index is less than 6; moisture-density control is important.
Windy (WcD, WcE)--	Strongly sloping to steep soils in mountainous areas; as much as 50 percent of the soil profile consists of pebbles of andesite; in places 10 to 30 percent of the soil mass consists of rounded cobblestones.	High seepage rate; soil material is very cobbly and gravelly; bedrock is weathered; soils are normally on ridges.	Low to intermediate resistance to piping and intermediate susceptibility to settlement cracking; moisture-density control is important.

Descriptions of the Soils

This section is provided for those who want detailed information about the soils. It describes the individual soils, or mapping units, in the Area; that is, the areas on the detailed soil map that are bounded by lines and identified by a letter symbol. For more generalized information about soils, the reader can refer to the section "General Soil Map." The approximate acreage and proportionate extent of the soils are given in table 7. A list of the soils mapped, along with the capability unit of each, the range site, and the woodland suitability group, is given in the back of this report.

TABLE 7.—*Approximate acreage and proportionate extent of the soils*

Map symbol	Soil	Acres	Percent
AdD	Ahwahnee very rocky loam, 9 to 31 percent slopes	1,198	0.4
AaB	Ahwahnee loam, 3 to 9 percent slopes	89	(1)
AaB2	Ahwahnee loam, 3 to 9 percent slopes, eroded	99	(1)
AaC	Ahwahnee loam, 9 to 16 percent slopes	323	.1
AaC2	Ahwahnee loam, 9 to 16 percent slopes, eroded	348	.1
AaD	Ahwahnee loam, 16 to 31 percent slopes	144	(1)
AaD2	Ahwahnee loam, 16 to 31 percent slopes, eroded	115	(1)
AdD3	Ahwahnee very rocky loam, 16 to 31 percent slopes, severely eroded	103	(1)
AdE	Ahwahnee very rocky loam, 31 to 51 percent slopes	881	.3
AfD	Ahwahnee extremely rocky loam, 9 to 51 percent slopes	122	(1)
AeE	Ahwahnee very rocky loam, shallow, 16 to 51 percent slopes	461	.2
AkC	Aiken cobbly loam, 3 to 16 percent slopes	2,192	.7
AhB	Aiken loam, 3 to 9 percent slopes	462	.2
AhC	Aiken loam, 9 to 16 percent slopes	994	.3
AkD	Aiken cobbly loam, 16 to 31 percent slopes	1,205	.4
AkE	Aiken cobbly loam, 31 to 51 percent slopes	606	.2
AmE	Aiken very rocky loam, 16 to 51 percent slopes	902	.3
AmF	Aiken very rocky loam, 51 to 71 percent slopes	631	.2
AoD	Argonaut very rocky loam, 3 to 31 percent slopes	3,098	1.0
AnD	Argonaut gravelly loam, 3 to 31 percent slopes	697	.2
AsD	Auburn very rocky silt loam, 3 to 31 percent slopes	23,378	7.8
ApD	Auburn silt loam, 0 to 31 percent slopes	6,983	2.3
AsB2	Auburn very rocky silt loam, 3 to 9 percent slopes, eroded	308	.1
AsE	Auburn very rocky silt loam, 31 to 51 percent slopes	6,525	2.2
AuD	Auburn extremely rocky silt loam, 3 to 31 percent slopes	1,269	.4
AuF	Auburn extremely rocky silt loam, 31 to 71 percent slopes	1,284	.4
ArC	Auburn silt loam, moderately deep, 3 to 16 percent slopes	1,634	.6
ArD	Auburn silt loam, moderately deep, 16 to 31 percent slopes	429	.1
AtD	Auburn very rocky silt loam, moderately deep, 3 to 31 percent slopes	2,002	.7
AtE	Auburn very rocky silt loam, moderately deep, 31 to 51 percent slopes	1,778	.6
AvE	Auburn extremely rocky silt loam, moderately deep, 31 to 71 percent slopes	533	.2
AwC	Auburn-Argonaut silt loams, 0 to 16 percent slopes	1,445	.5
AxD	Auburn-Argonaut very rocky silt loams, 3 to 31 percent slopes	3,554	1.2
CbE	Cohasset very cobbly loam, 16 to 51 percent slopes	4,958	1.7
CaC	Cohasset loam, 5 to 16 percent slopes	133	(1)
CaD	Cohasset loam, 16 to 31 percent slopes	110	(1)
CbC	Cohasset very cobbly loam, 3 to 16 percent slopes	794	.3
CbF	Cohasset very cobbly loam, 51 to 71 percent slopes	509	.2
CcC	Cohasset very cobbly loam, moderately deep, 3 to 16 percent slopes	480	.2
CcE	Cohasset very cobbly loam, moderately deep, 16 to 51 percent slopes	3,016	1.0
CoC	Cohasset very cobbly sandy loam, 3 to 16 percent slopes	484	.2
CoE	Cohasset very cobbly sandy loam, 16 to 51 percent slopes	2,553	.9
EcD	Exchequer very rocky silt loam, 3 to 31 percent slopes	6,657	2.2
EcE	Exchequer very rocky silt loam, 31 to 51 percent slopes	11,827	4.0
EhD	Exchequer and Auburn loams, 3 to 31 percent slopes	2,792	.9
ExD	Exchequer and Auburn very rocky loams, 3 to 31 percent slopes	10,011	3.4
ExE	Exchequer and Auburn very rocky loams, 31 to 51 percent slopes	5,071	1.7
FoE	Fiddletown very rocky loam, 16 to 51 percent slopes	3,274	1.1
FgB	Fiddletown gravelly loam, deep, 3 to 10 percent slopes	65	(1)
FtE	Fiddletown very rocky loam, deep, 16 to 51 percent slopes	214	(1)
FdC	Fiddletown gravelly loam, 9 to 16 percent slopes	519	.2
FdD	Fiddletown gravelly loam, 16 to 31 percent slopes	405	.1
FoF	Fiddletown very rocky loam, 51 to 71 percent slopes	1,353	.4
HaD	Henneke very rocky loam, 3 to 51 percent slopes	2,064	.7
HdD	Holland coarse sandy loam, deep, 9 to 16 percent slopes	317	.1
HdC	Holland coarse sandy loam, deep, 5 to 9 percent slopes	89	(1)
HkE	Holland very rocky coarse sandy loam, deep, 16 to 51 percent slopes	457	.1
HcC	Holland coarse sandy loam, 5 to 9 percent slopes	81	(1)
HcD	Holland coarse sandy loam, 9 to 16 percent slopes	127	(1)
HcE	Holland coarse sandy loam, 16 to 36 percent slopes	104	(1)
HfD	Holland very rocky coarse sandy loam, 9 to 16 percent slopes	378	.1
HfE	Holland very rocky coarse sandy loam, 16 to 51 percent slopes	565	.2
HfF	Holland very rocky coarse sandy loam, 51 to 71 percent slopes	544	.2
Ho	Honcut very fine sandy loam	2,451	.8
Hs	Honcut very fine sandy loam, moderately well drained	1,033	.3
Hv	Honcut very fine sandy loam, channeled	412	.1
Hn	Honcut silt loam	583	.2

See footnote at end of table.

TABLE 7.—*Approximate acreage and proportionate extent of the soils*—Continued

Map symbol	Soil	Acres	Percent
Hm	Honcut clay loam, over clay	525	0.2
IdC	Inks loam, deep variant, 3 to 16 percent slopes	157	(1)
IrE	Inks loam and Rock land, 3 to 45 percent slopes	5,923	2.0
IsE	Iron Mountain very stony loam, 9 to 51 percent slopes	2,091	.7
IvE	Iron Mountain very stony loam, rhyolite substratum, 9 to 51 percent slopes	358	.1
JgE	Jiggs very rocky loam, 16 to 51 percent slopes	367	.1
JoE	Josephine very rocky loam, 16 to 51 percent slopes	7,623	2.5
JnC	Josephine loam, deep, 9 to 16 percent slopes	244	(1)
JnD	Josephine loam, deep, 16 to 31 percent slopes	267	(1)
JnE	Josephine loam, deep, 31 to 51 percent slopes	546	.2
JpE	Josephine very rocky loam, deep, 16 to 51 percent slopes	2,541	.8
JpF	Josephine very rocky loam, deep, 51 to 71 percent slopes	307	.1
JmC	Josephine loam, 3 to 16 percent slopes	237	(1)
JmD	Josephine loam, 16 to 31 percent slopes	704	.2
JmE	Josephine loam, 31 to 51 percent slopes	155	(1)
JoC	Josephine very rocky loam, 3 to 16 percent slopes	573	.2
JoF	Josephine very rocky loam, 51 to 71 percent slopes	1,973	.7
JxE	Josephine-Mariposa complex, 16 to 51 percent slopes	3,801	1.3
JxF	Josephine-Mariposa complex, 51 to 71 percent slopes	1,362	.5
JsE	Josephine-Maymen complex, 16 to 51 percent slopes	3,266	1.1
LaC	Laniger sandy loam, 2 to 16 percent slopes	1,163	.4
LgB	Laniger sandy loam, thick surface, 0 to 5 percent slopes	218	(1)
Ln	Limestone rock land	412	.1
Lo	Loamy alluvial land	381	.1
Ma	Made land	227	(1)
McE	Mariposa very rocky loam, 31 to 51 percent slopes	13,478	4.5
MbD	Mariposa gravelly loam, 3 to 31 percent slopes	1,080	.4
McD	Mariposa very rocky loam, 9 to 31 percent slopes	3,609	1.2
McF	Mariposa very rocky loam, 51 to 85 percent slopes	4,761	1.6
MdE	Mariposa-Maymen complex, 16 to 51 percent slopes	1,752	.6
MdF	Mariposa-Maymen complex, 51 to 85 percent slopes	762	.2
MgE	Maymen very rocky loam, 9 to 51 percent slopes	2,103	.7
MhE	Maymen-Mariposa complex, 16 to 51 percent slopes	1,000	.3
MlC	McCarthy very cobbly loam, 3 to 16 percent slopes	238	(1)
MkE	McCarthy very rocky loam, 16 to 51 percent slopes	804	.3
MkF	McCarthy very rocky loam, 51 to 71 percent slopes	619	.2
MmE	McCarthy and Jiggs very cobbly loams, 16 to 51 percent slopes	1,315	.4
Mn	Mine tailings and Riverwash	3,314	1.1
Mo	Mixed alluvial land	1,379	.5
Mp	Mixed wet alluvial land	208	(1)
MrB	Mokelumne sandy loam, 2 to 5 percent slopes	208	(1)
MsD	Mokelumne coarse sandy loam, 5 to 36 percent slopes	451	0.1
Mt	Mokelumne soils and Alluvial land	1,128	.4
MvE	Musick very rocky sandy loam, 16 to 51 percent slopes	3,212	1.1
MuB	Musick sandy loam, 3 to 9 percent slopes	147	(1)
MuC	Musick sandy loam, 9 to 16 percent slopes	184	(1)
MuD	Musick sandy loam, 16 to 31 percent slopes	130	(1)
MuE	Musick sandy loam, 31 to 51 percent slopes	320	.1
MvC	Musick very rocky sandy loam, 9 to 16 percent slopes	775	.3
MvF	Musick very rocky sandy loam, 51 to 71 percent slopes	1,578	.5
MwE	Musick very rocky sandy loam, moderately deep, 16 to 51 percent slopes	308	.1
MwF	Musick very rocky sandy loam, moderately deep, 51 to 71 percent slopes	434	.2
MxF	Musick extremely rocky sandy loam, moderately deep, 51 to 71 percent slopes	572	.2
PaD	Pardee cobbly loam, 3 to 31 percent slopes	3,869	1.3
PnC	Pentz sandy loam, 2 to 16 percent slopes	4,924	1.7
PnC2	Pentz sandy loam, 9 to 16 percent slopes, eroded	218	.1
PnD	Pentz sandy loam, 16 to 31 percent slopes	541	.2
PpC	Pentz gravelly sandy loam, 2 to 16 percent slopes	279	(1)
PoE	Pentz sandy loam, very shallow, 2 to 51 percent slopes	3,419	1.1
PrA	Perkins loam, 0 to 3 percent slopes	474	.2
PrC	Perkins loam, 3 to 16 percent slopes	560	.2
PtB	Peters clay, 3 to 9 percent slopes	177	(1)
Pw	Placer diggings and Riverwash	5,278	1.8
RbD	Red Bluff-Mokelumne complex, 5 to 16 percent slopes	5,365	1.8
RbB	Red Bluff-Mokelumne complex, 0 to 5 percent slopes	1,971	.7
RbE2	Red Bluff-Mokelumne complex, 16 to 36 percent slopes, eroded	893	.3
RmD	Red Bluff-Mokelumne-Mine pits complex, 2 to 16 percent slopes	597	.2
Ro	Rock land	12,273	4.1
RyA	Ryer silty clay loam, 0 to 3 percent slopes	881	.3
Sa	Sedimentary rock land	7,160	2.4
Sb	Serpentine rock land	3,468	1.2
ScF	Shaver very rocky coarse sandy loam, 51 to 71 percent slopes	556	.2
SdF	Shaver very rocky coarse sandy loam, moderately deep, 51 to 71 percent slopes	214	(1)
SfB	Shenandoah loam, 3 to 9 percent slopes	333	.1
SgC	Sierra coarse sandy loam, 9 to 16 percent slopes	837	.3
SgB	Sierra coarse sandy loam, 3 to 9 percent slopes	509	.2
SgB2	Sierra coarse sandy loam, 3 to 9 percent slopes, eroded	917	.3
SgC2	Sierra coarse sandy loam, 9 to 16 percent slopes, eroded	731	.2
SgD	Sierra coarse sandy loam, 16 to 31 percent slopes	535	.2
SgD2	Sierra coarse sandy loam, 16 to 31 percent slopes, eroded	358	.1
SkD	Sierra very rocky coarse sandy loam, 16 to 31 percent slopes	1,557	.5
SkF	Sierra very rocky coarse sandy loam, 51 to 71 percent slopes	489	.2

See footnote at end of table.

TABLE 7.—*Approximate acreage and proportionate extent of the soils*—Continued

Map symbol	Soil	Acres	Percent	Map symbol	Soil	Acres	Percent
ShB	Sierra coarse sandy loam, moderately deep, 3 to 9 percent slopes	352	0.1	SoE	Sites loam, moderately deep, 31 to 51 percent slopes	744	0.2
ShB2	Sierra coarse sandy loam, moderately deep, 3 to 9 percent slopes, eroded	85	(1)	SpD3	Sites clay loam, moderately deep, 3 to 31 percent slopes, severely eroded	148	(1)
ShC	Sierra coarse sandy loam, moderately deep, 9 to 16 percent slopes	376	.1	SsE	Sites very rocky loam, moderately deep, 16 to 51 percent slopes	1,143	.4
ShC2	Sierra coarse sandy loam, moderately deep, 9 to 16 percent slopes, eroded	374	.1	StE	Sites-Mariposa complex, 16 to 51 percent slopes	3,762	1.3
ShD	Sierra coarse sandy loam, moderately deep, 16 to 31 percent slopes	233	(1)	SwD	Snelling sandy loam, 9 to 16 percent slopes	362	.1
ShD2	Sierra coarse sandy loam, moderately deep, 16 to 31 percent slopes, eroded	384	.1	SwE	Snelling sandy loam, 16 to 31 percent slopes	185	(1)
SmD	Sierra very rocky coarse sandy loam, moderately deep, 9 to 31 percent slopes	606	.2	SvA	Snelling fine sandy loam, 0 to 2 percent slopes	58	(1)
SmE	Sierra very rocky coarse sandy loam, moderately deep, 31 to 51 percent slopes	564	.2	SvB	Snelling fine sandy loam, 2 to 5 percent slopes	63	(1)
SlD3	Sierra sandy clay loam, 9 to 31 percent slopes, severely eroded	148	(1)	SvC	Snelling fine sandy loam, 5 to 9 percent slopes	177	(1)
SrE	Sites very rocky loam, 16 to 51 percent slopes	5,146	1.7	SuB	Snelling loam, moderately well drained, 0 to 9 percent slopes	205	(1)
SnB	Sites loam, 3 to 9 percent slopes	181	(1)	SxD	Supan cobbly loam, 3 to 31 percent slopes	1,548	.5
SnC	Sites loam, 9 to 16 percent slopes	404	.1	SyE	Supan very cobbly loam, moderately deep, 31 to 51 percent slopes	958	.3
SnD	Sites loam, 16 to 31 percent slopes	403	.1	SyD	Supan very cobbly loam, moderately deep, 3 to 31 percent slopes	697	.2
SnE	Sites loam, 31 to 51 percent slopes	1,656	.5	TcE	Tiger Creek very rocky loam, 16 to 51 percent slopes	269	(1)
SrC	Sites very rocky loam, 3 to 16 percent slopes	2,089	.7	WcE	Windy cobbly sandy loam, 16 to 51 percent slopes	1,308	.4
SrF	Sites very rocky loam, 51 to 85 percent slopes	1,112	.4	WcD	Windy cobbly sandy loam, 9 to 16 percent slopes	287	.1
SoC	Sites loam, moderately deep, 3 to 16 percent slopes	878	.3				
SoD	Sites loam, moderately deep, 16 to 31 percent slopes	1,192	.4		Total	298,992	97.7

[1] Less than 0.1 percent; acreage of all soils bearing this footnote totals 2.3 percent of the Area.

Some terms used to describe soil properties in this section and throughout the report are defined in the paragraphs that follow.

Drainage refers to the wetness of the soil profile, based on observations of free water on the surface or at different depths. It also takes into consideration the morphological characteristics of the profile that are affected by different degrees of aeration within the profile.

Effective depth is the depth of soil readily penetrated by roots. It is the depth to claypan, bedrock, or any other layer in the soil that would stop or hinder the penetration of roots. Limits of the classes are—

	Inches
Very deep	More than 60.
Deep	36 to 60.
Moderately deep	20 to 36.
Shallow	10 to 20.
Very shallow	Less than 10.

Erosion hazard is the susceptibility of the soil to erosion by water or wind. In general, the risk of erosion depends on the texture, structure, and slope of the soil, on its cover of vegetation, and the amount of runoff. In this report the erosion hazard is an estimate of the degree of erosion to be expected if the soil is left finely tilled or if the protective vegetation is removed by fire or other means before the rainy season.

The amount of erosion is indicated in the names of many of the mapping units. Soils that have lost from 25 to 75 percent of the original surface layer are mapped as *eroded*. Soils that have lost 75 percent or more of the original surface layer and as much as 25 percent of their subsoil are mapped as *severely eroded*. Occasional deep gullies and frequent small gullies also may be present in severely eroded soils. Some areas have also been mined, and conspicuous mounds and pits have been left intermingled with areas that are relatively undisturbed.

Fertility ratings are estimates of the natural ability of the soil to provide the proper nutrients, in the proper amounts and in the right balance, for growth of the usual crops when other factors, such as light, temperature, and physical condition of the soil, are favorable. Estimates were made in relation to the other soils of this Area. Terms used are *very low, low, moderate, high*, and *very high*.

Permeability is the ability of a porous material, such as soil, to transmit fluids. Permeability of soil is expressed by the rate of percolation. Since measurements have not been made on these soils, the ratings given are estimates. The basis for estimating is the rate of percolation, by gravity, through a saturated core of soil about 3 inches in diameter and 3 inches in thickness, that was taken with the least possible disturbance of natural soil

structure. The rating of permeability is a general indication of the ease of root penetration. The classes and their percolation rates per hour are—

	Inches
Very slow	Less than 0.05.
Slow	0.05 to 0.20.
Moderately slow	0.20 to 0.80.
Moderate	0.80 to 2.50.
Moderately rapid	2.50 to 5.00.
Rapid	5.00 to 10.00.
Very rapid	More than 10.00.

Runoff refers to the relative rate that water is removed by flow over the surface of the soil. The classes are *very slow, slow, medium, rapid,* and *very rapid.*

The *texture* of many of the soils is modified because of the content of coarse fragments in the soils. Soils are mapped as very rocky where exposures of bedrock or very shallow depths to bedrock make tillage of crops impractical. In very rocky soils rock outcrops generally cover from 10 to 25 percent of the surface and are about 30 to 100 feet apart.

In extremely rocky soils exposures of bedrock cover from 25 to 75 percent of the surface, are about 10 to 30 feet apart, and make the use of all machinery impractical. Extremely rocky soils may have some value for pasture or forestry.

Gravelly soils contain 17 to 50 percent gravel by volume. Gravel consists of rock fragments larger than 2 millimeters in diameter and as much as 3 inches in diameter.

In cobbly soils, cobblestones occupy from 5 to 30 percent of the profile by volume. The cobblestones are

TABLE 8.—*Summary of*

Map symbol	Name of soil	Drainage class	Runoff class	Permeability
				Surface
AdD	Ahwahnee very rocky loam, 9 to 31 percent slopes	Well drained	Medium to rapid	Moderate
AaB	Ahwahnee loam, 3 to 9 percent slopes	Well drained	Slow to medium	Moderate
AaB2	Ahwahnee loam, 3 to 9 percent slopes, eroded	Well drained	Slow to medium	Moderate
AaC	Ahwahnee loam, 9 to 16 percent slopes	Well drained	Medium to rapid	Moderate
AaC2	Ahwahnee loam, 9 to 16 percent slopes, eroded	Well drained	Medium to rapid	Moderate
AaD	Ahwahnee loam, 16 to 31 percent slopes	Well drained	Rapid	Moderate
AaD2	Ahwahnee loam, 16 to 31 percent slopes, eroded	Well drained	Rapid	Moderate
AdD3	Ahwahnee very rocky loam, 16 to 31 percent slopes, severely eroded.	Well drained	Very rapid	Moderate
AdE	Ahwahnee very rocky loam, 31 to 51 percent slopes	Well drained	Very rapid	Moderate
AfD	Ahwahnee extremely rocky loam, 9 to 51 percent slopes	Well drained	Medium to very rapid.	Moderate
AeE	Ahwahnee very rocky loam, shallow, 16 to 51 percent slopes.	Well drained to somewhat excessively drained.	Rapid to very rapid	Moderate
AkC	Aiken cobbly loam, 3 to 16 percent slopes	Well drained	Slow to medium	Moderate
AhB	Aiken loam, 3 to 9 percent slopes	Well drained	Slow	Moderate
AhC	Aiken loam, 9 to 16 percent slopes	Well drained	Slow to medium	Moderate
AkD	Aiken cobbly loam, 16 to 31 percent slopes	Well drained	Medium to rapid	Moderate
AkE	Aiken cobbly loam, 31 to 51 percent slopes	Well drained	Rapid	Moderate
AmE	Aiken very rocky loam, 16 to 51 percent slopes	Well drained	Medium to rapid	Moderate
AmF	Aiken very rocky loam, 51 to 71 percent slopes	Well drained	Very rapid	Moderate
AoD	Argonaut very rocky loam, 3 to 31 percent slopes	Moderately well drained	Medium to rapid	Moderate
AnD	Argonaut gravelly loam, 3 to 31 percent slopes	Moderately well drained	Medium to rapid	Moderate
AsD	Auburn very rocky silt loam, 3 to 31 percent slopes	Well drained	Medium to very rapid.	Moderate
ApD	Auburn silt loam, 0 to 31 percent slopes	Well drained	Slow to very rapid	Moderate
AsB2	Auburn very rocky silt loam, 3 to 9 percent slopes, eroded.	Well drained	Medium	Moderate
AsE	Auburn very rocky silt loam, 31 to 51 percent slopes	Well drained	Very rapid	Moderate

numerous enough to interfere with tillage and to make intertillage of crops impractical unless the cobblestones are removed. Generally, cobblestones are rounded and range from 3 to 10 inches in diameter.

Soils are mapped as very cobbly if cobblestones occupy from 30 to 75 percent of the soil profile by volume. Tillage is impractical in very cobbly soils.

Very stony soils contain loose, rocky fragments generally more than 10 inches in diameter. The stones are 2½ to 5 feet apart and occupy 3 to 25 percent of the surface.

Workability refers to the amount of work required to till the soil, and the relative difficulty in handling farm machinery. Terms are easy, fairly easy, fairly difficult, and difficult.

Water-holding capacity (also referred to as available water holding capacity) is the capacity of the soil, to its effective depth as defined, to hold water available to plants, at normal field capacity. This is approximately the moisture content of a well-drained soil 2 or 3 days after it has been saturated by rain or by irrigation. The classes and the amount of water held in the soil to its effective depth are—

	Inches
Very low	Less than 2.
Low	2 to 4.
Moderate	4 to 6.
High	6 to 9.
Very high	More than 9.

A summary of the important qualities of each soil mapping unit is given in table 8.

important qualities of the soils

Permeability—Con. Subsoil	Available water holding capacity	Effective depth for roots	Natural fertility	Erosion hazard	Dominant natural vegetation and principal uses
Moderate	Moderate	Moderately deep to deep.	Moderate	Moderate to severe.	Grass-oak, scattered conifers; range.
Moderate	Moderate	Moderately deep to deep.	Moderate	Moderate	Grass-oak, scattered conifers; range.
Moderate	Low to moderate	Moderately deep	Moderate to low	Moderate	Grass-oak, scattered conifers; range.
Moderate	Moderate	Moderately deep to deep.	Moderate	Moderate to severe	Grass-oak, scattered conifers; range.
Moderate	Moderate	Moderately deep	Moderate to low	Moderate to severe.	Grass-oak, scattered conifers; range.
Moderate	Moderate	Moderately deep to deep.	Moderate	Severe	Grass-oak, scattered conifers; range.
Moderate	Low to moderate	Moderately deep	Moderate to low	Severe to very severe.	Grass-oak, scattered conifers; range.
Moderate	Low	Moderately deep to shallow.	Low	Very severe	Grass-oak, scattered conifers; range.
Moderate	Moderate	Moderately deep to deep.	Moderate	Very severe	Grass-oak, scattered conifers; range.
Moderate	Moderate	Moderately deep to deep.	Moderate	Moderate to very severe.	Grass-oak, scrattered conifers; range.
Moderate	Low	Moderately deep to shallow.	Moderate	Severe to very severe.	Grass-oak, dense brush, scattered conifers; range.
Moderately slow	Very high	Very deep	Moderate	Slight to moderate.	Conifers, hardwoods, brush, grass; timber.
Moderately slow	Very high	Very deep	Moderate	Slight	Conifers, hardwoods, brush, grass; timber.
Moderately slow	Very high	Very deep	Moderate	Moderate	Conifers, hardwoods, brush, grass; timber.
Moderately slow	Very high	Very deep	Moderate	Moderate to severe.	Conifers, hardwoods, brush, grass; timber.
Moderately slow	Very high	Very deep	Moderate	Severe	Conifers, hardwoods, brush, grass; timber.
Moderately slow	Very high	Very deep	Moderate	Moderate to very severe.	Conifers, hardwoods, brush, grass; timber.
Moderately slow	Very high	Very deep	Moderate	Very severe	Conifers, hardwoods, brush, grass; timber.
Very slow	Moderate	Shallow to moderately deep.	Moderate	Moderate to severe.	Grass-oak; range.
Very slow	Moderate	Shallow to moderately deep.	Moderate	Moderate to severe.	Grass-oak; range.
Moderate to moderately slow.	Moderate to low	Shallow	Moderate	Moderate to very severe.	Grass-oak; range.
Moderate to moderately slow.	Moderate to low	Shallow	Moderate	Moderate to very severe.	Grass-oak; range.
Moderate to moderately slow.	Moderate to low	Shallow	Moderate	Moderate	Grass-oak; range.
Moderate to moderately slow.	Moderate to low	Shallow	Moderate	Very severe	Grass-oak; range.

TABLE 8.—*Summary of important*

Map symbol	Name of soil	Drainage class	Runoff class	Permeability
				Surface
AuD	Auburn extremely rocky silt loam, 3 to 31 percent slopes	Well drained	Medium to very rapid.	Moderate
AuF	Auburn extremely rocky silt loam, 31 to 71 percent slopes.	Well drained	Very rapid	Moderate
ArC	Auburn silt loam, moderately deep, 3 to 16 percent slopes.	Well drained	Slow to medium	Moderate
ArD	Auburn silt loam, moderately deep, 16 to 31 percent slopes.	Well drained	Medium to rapid	Moderate
AtD	Auburn very rocky silt loam, moderately deep, 3 to 31 percent slopes.	Well drained	Slow to rapid	Moderate
AtE	Auburn very rocky silt loam, moderately deep, 31 to 51 percent slopes.	Well drained	Very rapid	Moderate
AvE	Auburn extremely rocky silt loam, moderately deep, 31 to 71 percent slopes.	Well drained	Very rapid	Moderate
AwC	Auburn-Argonaut silt loams, 0 to 16 percent slopes:			
	Auburn silt loam, 0 to 16 percent slopes	Well drained	Slow to medium	Moderate
	Argonaut silt loam, 0 to 16 percent slopes	Moderately well drained	Slow to medium	Moderate
AxD	Auburn-Argonaut very rocky silt loams, 3 to 31 percent slopes:			
	Auburn very rocky silt loam, 3 to 31 percent slopes.	Well drained	Medium to very rapid.	Moderate
	Argonaut very rocky silt loam, 3 to 31 percent slopes.	Moderately well drained	Medium to rapid	Moderate
CbE	Cohasset very cobbly loam, 16 to 51 percent slopes	Well drained	Medium to rapid	Moderate
CaC	Cohasset loam, 5 to 16 percent slopes	Well drained	Slow to medium	Moderate
CaD	Cohasset loam, 16 to 31 percent slopes	Well drained	Medium to rapid	Moderate
CbC	Cohasset very cobbly loam, 3 to 16 percent slopes	Well drained	Slow to medium	Moderate
CbF	Cohasset very cobbly loam, 51 to 71 percent slopes	Well drained	Very rapid	Moderate
CcC	Cohasset very cobbly loam, moderately deep, 3 to 16 percent slopes.	Well drained	Slow to medium	Moderate
CcE	Cohasset very cobbly loam, moderately deep, 16 to 51 percent slopes.	Well drained	Rapid to very rapid	Moderate
CoC	Cohasset very cobbly sandy loam, 3 to 16 percent slopes	Well drained	Slow to medium	Moderately rapid.
CoE	Cohasset very cobbly sandy loam, 16 to 51 percent slopes.	Well drained	Medium to very rapid.	Moderately rapid.
EcD	Exchequer very rocky silt loam, 3 to 31 percent slopes	Somewhat excessively drained.	Medium to very rapid.	Moderate
EcE	Exchequer very rocky silt loam, 31 to 51 percent slopes	Somewhat excessively drained.	Very rapid	Moderate
EhD	Exchequer and Auburn loams, 3 to 31 percent slopes:			
	Exchequer loam, 3 to 31 percent slopes	Well drained	Medium to rapid	Moderate
	Auburn loam, 3 to 31 percent slopes	Well drained	Medium to very rapid.	Moderate
ExD	Exchequer and Auburn very rocky loams, 3 to 31 percent slopes:			
	Exchequer very rocky loam, 3 to 31 percent slopes	Well drained	Medium to rapid	Moderate
	Auburn very rocky loam, 3 to 31 percent slopes	Well drained	Medium to very rapid.	Moderate
ExE	Exchequer and Auburn very rocky loams, 31 to 51 percent slopes:			
	Exchequer very rocky loam, 31 to 51 percent slopes	Well drained to somewhat excessively drained.	Variable	Moderate
	Auburn very rocky loam, 31 to 51 percent slopes	Well drained	Very rapid	Moderate
FoE	Fiddletown very rocky loam, 16 to 51 percent slopes	Well drained	Medium to very rapid.	Moderate

qualities of the soils—Continued

Permeability—Con. Subsoil	Available water holding capacity	Effective depth for roots	Natural fertility	Erosion hazard	Dominant natural vegetation and principal uses
Moderate to moderately slow.	Moderate to low	Shallow	Moderate	Moderate to very severe.	Grass-oak; range.
Moderate to moderately slow.	Moderate to low	Shallow	Moderate	Very severe	Grass-oak; range.
Moderate to moderately slow.	Moderate	Moderately deep	Moderate	Slight to moderate.	Grass-oak; range.
Moderate to moderately slow.	Moderate	Moderately deep	Moderate	Moderate to severe.	Grass-oak; range.
Moderate to moderately slow.	Moderate	Moderately deep	Moderate	Slight to severe	Grass-oak; range.
Moderate to moderately slow.	Moderate	Moderately deep	Moderate	Very severe	Grass-oak; range.
Moderate to moderately slow.	Moderate	Moderately deep	Moderate	Very severe	Grass-oak; range.
Moderate to very slow.	Moderate	Shallow	Moderate	Slight to moderate	Grass-oak; range.
Very slow	Moderate	Shallow to moderately deep.	Moderate	Slight to moderate	Grass-oak; range.
Moderate to moderately slow.	Moderate to low	Shallow	Moderate	Moderate to very severe.	Grass-oak; range.
Very slow	Moderate	Shallow to moderately deep.	Moderate	Moderate to severe.	Grass-oak; range.
Moderate to moderately slow.	High	Very deep	Moderate	Moderate to very severe.	Conifers, hardwoods, brush, grass; timber.
Moderate to moderately slow.	High	Very deep	Moderate	Slight to moderate.	Conifers, hardwoods, brush, grass; timber.
Moderate to moderately slow.	High	Very deep	Moderate	Moderate to severe.	Conifers, hardwoods, brush, grass; timber.
Moderate to moderately slow.	High	Very deep	Moderate	Slight to moderate.	Conifers, hardwoods, brush, grass; timber.
Moderate to moderately slow.	High	Very deep	Moderate	Very severe	Conifers, hardwoods, brush, grass; timber.
Moderately slow	Moderate	Moderately deep to deep.	Moderate	Slight to severe	Conifers, hardwoods, brush, grass; timber.
Moderately slow	Moderate	Moderately deep to deep.	Moderate	Severe to very severe.	Conifers, hardwoods, brush, grass; timber.
Moderate	High	Very deep	Moderate	Slight to moderate.	Conifers, hardwoods, brush, grass; timber.
Moderate	High	Very deep	Moderate	Severe to very severe.	Conifers, hardwoods, brush, grass; timber.
Moderate	Very low	Very shallow	Low	Moderate to very severe.	Scattered oak and digger pine; dense brush; sparse grass; limited range.
Moderate	Very low	Very shallow	Low	Very severe	Scattered oak and digger pine; dense brush; sparse grass; limited range.
Moderate	Low to moderate	Moderately deep	Low to moderate	Moderate to very severe.	Brush, grass, oak; range.
Moderate to moderately slow.	Moderate to low	Shallow	Moderate	Moderate to severe.	Grass-oak; range.
Moderate	Very low	Moderately deep	Low to moderate	Moderate to very severe.	Brush, grass, oak; range.
Moderate to moderately slow.	Moderate to low	Shallow	Moderate	Moderate to very severe.	Grass-oak; range.
Moderate	Very low	Moderately deep	Low to moderate	Very severe	Brush, grass, oak; range.
Moderate to moderately slow.	Moderate to low	Shallow	Moderate	Very severe	Grass-oak; range.
Moderate to moderately rapid.	Moderate to low	Moderately deep	Moderate	Moderate to very severe.	Conifers, brush, hardwoods, grass; timber-range.

TABLE 8.—*Summary of important*

Map symbol	Name of soil	Drainage class	Runoff class	Permeability
				Surface
FgB	Fiddletown gravelly loam, deep, 3 to 10 percent slopes	Well drained	Slow to medium	Moderate
FtE	Fiddletown very rocky loam, deep, 16 to 51 percent slopes.	Well drained	Medium to very rapid.	Moderate
FdC	Fiddletown gravelly loam, 9 to 16 percent slopes	Well drained	Medium	Moderate
FdD	Fiddletown gravelly loam, 16 to 31 percent slopes	Well drained	Rapid	Moderate
FoF	Fiddletown very rocky loam, 51 to 71 percent slopes	Well drained	Very rapid	Moderate
HaD	Henneke very rocky loam, 3 to 51 percent slopes	Somewhat excessively drained.	Medium to very rapid.	Moderate
HdD	Holland coarse sandy loam, deep, 9 to 16 percent slopes	Well drained	Medium	Moderately rapid.
HdC	Holland coarse sandy loam, deep, 5 to 9 percent slopes	Well drained	Slow	Moderately rapid.
HkE	Holland very rocky coarse sandy loam, deep, 16 to 51 percent slopes.	Well drained	Rapid to very rapid	Moderately rapid.
HcC	Holland coarse sandy loam, 5 to 9 percent slopes	Well drained	Slow	Moderately rapid.
HcD	Holland coarse sandy loam, 9 to 16 percent slopes	Well drained	Medium to rapid	Moderately rapid.
HcE	Holland coarse sandy loam, 16 to 36 percent slopes	Well drained	Rapid	Moderately rapid.
HfD	Holland very rocky coarse sandy loam, 9 to 16 percent slopes.	Well drained	Medium	Moderately rapid.
HfE	Holland very rocky coarse sandy loam, 16 to 51 percent slopes.	Well drained	Rapid to very rapid	Moderately rapid.
HfF	Holland very rocky coarse sandy loam, 51 to 71 percent slopes.	Well drained	Very rapid	Moderately rapid.
Ho	Honcut very fine sandy loam	Well drained	Slow	Moderate
Hs	Honcut very fine sandy loam, moderately well drained	Moderately well drained	Slow	Moderate
Hv	Honcut very fine sandy loam, channeled	Well drained	Slow	Moderate to moderately rapid.
Hn	Honcut silt loam	Well drained; in places moderately well drained.	Slow	Moderate
Hm	Honcut clay loam, over clay	Moderately well drained	Slow	Moderately slow.
IdC	Inks loam, deep variant, 3 to 16 percent slopes	Well drained	Slow to medium	Moderate
IrE	Inks loam and Rock land, 3 to 45 percent slopes: Inks loam, 3 to 45 percent slopes	Somewhat excessively drained.	Medium to very rapid.	Moderate
	Rock land	Excessively drained	Very rapid	Rapid
IsE	Iron Mountain very stony loam, 9 to 51 percent slopes	Well drained	Medium to very rapid.	Moderate
IvE	Iron Mountain very stony loam, rhyolite substratum, 9 to 51 percent slopes.	Somewhat excessively drained to well drained.	Rapid to very rapid	Moderate
JgE	Jiggs very rocky loam, 16 to 51 percent slopes	Well drained	Medium to very rapid.	Moderate
JoE	Josephine very rocky loam, 16 to 51 percent slopes	Well drained	Medium to very rapid.	Moderate

qualities of the soils—Continued

Permeability—Con. Subsoil	Available water holding capacity	Effective depth for roots	Natural fertility	Erosion hazard	Dominant natural vegetation and principal uses
Moderate	Moderate	Deep	Moderate	Slight to moderate	Conifers, brush, hardwoods, grass; timber-range.
Moderate	Moderate	Deep	Moderate	Moderate to very severe.	Conifers, brush, hardwoods, grass; timber-range.
Moderate to moderately rapid.	Moderate to low	Moderately deep	Moderate	Moderate	Conifers, brush, hardwoods, grass; timber-range.
Moderate to moderately rapid.	Moderate to low	Moderately deep	Moderate	Moderate to severe.	Conifers, brush, hardwoods, grass.
Moderate to moderately rapid.	Moderate to low	Moderately deep	Moderate	Very severe	Conifers, brush, hardwoods, grass; timber-range.
Moderate	Very low	Very shallow	Very low	Moderate to very severe.	Dense brush, sparse grass; limited range; wildlife, watershed.
Moderate	High	Very deep	Moderate	Moderate to severe.	Conifers, hardwoods, brush, grass; timber.
Moderate	High	Very deep	Moderate	Moderate	Conifers, hardwoods, brush, grass; timber.
Moderate	High	Very deep	Moderate	Very severe	Conifers, hardwoods, brush, grass; timber.
Moderate	Moderate	Deep to moderately deep.	Moderate	Moderate	Conifers, hardwoods, brush, grass; timber.
Moderate	Moderate	Deep to moderately deep.	Moderate	Moderate to severe.	Conifers, hardwoods, brush, grass; timber.
Moderate	Moderate	Deep to moderately deep.	Moderate	Very severe	Conifers, hardwoods, brush, grass; timber.
Moderate	Moderate	Deep to moderately deep.	Moderate	Moderate to severe.	Conifers, hardwoods, brush, grass; timber.
Moderate	Moderate	Deep to moderately deep.	Moderate	Very severe	Conifers, hardwoods, brush, grass; timber.
Moderate	Moderate	Deep to moderately deep.	Moderate	Very severe	Conifers, hardwoods, brush, grass; timber.
Moderate to moderately slow.	Very high	Very deep	Very high	Slight	Annual grass and forbs, a few oaks; cropland.
Moderate to slow	Very high	Very deep	Very high	Slight	Annual grass and forbs, a few oaks, some wiregrass and sedge; cropland.
Moderate to slow	Very high	Very deep	Moderate to high	Channeled; subject to occasional flooding.	Annual grass and forbs, a few oaks; cropland when protected; range.
Moderate to slow	Very high	Very deep	Very high	Slight	Annual grass and forbs, a few oaks, some wiregrass and sedge; cropland.
Slow to very slow	High	Moderately deep	Moderate	Slight	Annual grass and forbs, a few oaks, some wiregrass and sedge; cropland.
Moderate to moderately slow.	Moderate	Moderately deep	Moderate	Slight to moderate.	Grass-oak; range.
Moderate	Low to very low	Shallow to very shallow.	Low to moderate	Moderate to very severe.	Brush-grass-oak; limited range; wildlife, watershed.
Absent	Very low	Very shallow	Low	Very severe	Sparse grass, conifers, dense brush, a few hardwoods; wildlife, watershed.
Moderate	Low	Shallow	Moderate	Moderate to very severe.	Brush-grass-oak; range.
Moderate	Low	Shallow	Moderate to low	Severe to very severe.	Mixed conifers, brush, grass; timber-range.
Moderate	Moderate	Moderately deep	Moderate	Moderate to very severe.	Mixed conifers, brush, grass; timber-range.
Moderately slow	Moderate	Moderately deep	Moderate	Moderate to very severe.	Conifers, hardwoods, brush, grass; timber with some grazing.

TABLE 8.—*Summary of important*

Map symbol	Name of soil	Drainage class	Runoff class	Permeability
				Surface
JnC	Josephine loam, deep, 9 to 16 percent slopes	Well drained	Medium	Moderate
JnD	Josephine loam, deep, 16 to 31 percent slopes	Well drained	Rapid	Moderate
JnE	Josephine loam, deep, 31 to 51 percent slopes	Well drained	Very rapid	Moderate
JpE	Josephine very rocky loam, deep, 16 to 51 percent slopes	Well drained	Rapid to very rapid	Moderate
JpF	Josephine very rocky loam, deep, 51 to 71 percent slopes	Well drained	Very rapid	Moderate
JmC	Josephine loam, 3 to 16 percent slopes	Well drained	Medium	Moderate
JmD	Josephine loam, 16 to 31 percent slopes	Well drained	Medium to rapid	Moderate
JmE	Josephine loam, 31 to 51 percent slopes	Well drained	Very rapid	Moderate
JoC	Josephine very rocky loam, 3 to 16 percent slopes	Well drained	Medium	Moderate
JoF	Josephine very rocky loam, 51 to 71 percent slopes	Well drained	Very rapid	Moderate
JxE	Josephine-Mariposa complex, 16 to 51 percent slopes: Josephine very rocky loam, 16 to 51 percent slopes	Well drained	Medium to very rapid.	Moderate
	Mariposa very rocky loam, 31 to 51 percent slopes	Well drained	Very rapid	Moderate
JxF	Josephine-Mariposa complex, 51 to 71 percent slopes: Josephine very rocky loam, 51 to 71 percent slopes	Well drained	Very rapid	Moderate
	Mariposa very rocky loam, 51 to 71 percent slopes	Well drained to somewhat excessively drained.	Very rapid	Moderate
JsE	Josephine-Maymen complex, 16 to 51 percent slopes: Josephine very rocky loam, 16 to 51 percent slopes	Well drained	Medium to very rapid.	Moderate
	Maymen very rocky loam, 16 to 51 percent slopes	Somewhat excessively drained.	Very rapid to rapid	Moderate
LaC	Laniger sandy loam, 2 to 16 percent slopes	Well drained	Slow to medium	Moderately rapid.
LgB	Laniger sandy loam, thick surface, 0 to 5 percent slopes	Moderately well drained	Slow	Moderately rapid.
Ln	Limestone rock land	Excessively drained	Very rapid	Rapid
Lo	Loamy alluvial land	Well drained	Slow	Moderate to variable.
Ma	Made land	Well drained to moderately well drained.	Slow	Variable but mostly moderate.
McE	Mariposa very rocky loam, 31 to 51 percent slopes	Well drained	Very rapid	Moderate
MbD	Mariposa gravelly loam, 3 to 31 percent slopes	Well drained	Medium to rapid	Moderate
McD	Mariposa very rocky loam, 9 to 31 percent slopes	Well drained	Rapid	Moderate
McF	Mariposa very rocky loam, 51 to 85 percent slopes	Well drained to somewhat excessively drained.	Very rapid	Moderate
MdE	Mariposa-Maymen complex, 16 to 51 percent slopes: Mariposa very rocky loam, 16 to 51 percent slopes	Well drained	Rapid to very rapid	Moderate
	Maymen very rocky loam, 16 to 51 percent slopes	Somewhat excessively drained.	Very rapid to rapid	Moderate

qualities of the soils—Continued

Permeability—Con. Subsoil	Available water holding capacity	Effective depth for roots	Natural fertility	Erosion hazard	Dominant natural vegetation and principal uses
Moderately slow	High	Deep	Moderate	Moderate	Conifers, hardwoods, brush, grass; timber.
Moderately slow	High	Deep	Moderate	Moderate to severe.	Conifers, hardwoods, brush, grass; timber.
Moderately slow	High	Deep	Moderate	Severe to very severe.	Conifers, hardwoods, brush, grass; timber.
Moderately slow	High	Deep	Moderate	Moderate to very severe.	Conifers, hardwoods, brush, grass; timber.
Moderately slow	High	Deep	Moderate	Very severe	Conifers, hardwoods, brush, grass; timber.
Moderately slow	Moderate	Moderately deep	Moderate	Moderate	Conifers, hardwoods, brush, grass; timber.
Moderately slow	Moderate	Moderately deep	Moderate	Moderate to severe.	Conifers, hardwoods, brush, grass; timber.
Moderately slow	Moderate	Moderately deep	Moderate	Very severe	Conifers, hardwoods, brush, grass; timber.
Moderately slow	Moderate	Moderately deep	Moderate	Moderate	Conifers, hardwoods, brush, grass; timber.
Moderately slow	Moderate	Moderately deep	Moderate	Very severe	Conifers, hardwoods, brush, grass; timber.
Moderately slow	Moderate	Moderately deep	Moderate	Moderate to very severe.	Conifers, hardwoods, brush, grass; timber with some grazing.
Moderate	Low	Shallow	Low to moderate	Very severe	Conifers, hardwoods, brush, grass; timber.
Moderately slow	Moderate	Moderately deep	Moderate	Very severe	Conifers, hardwoods, brush, brass; timber.
Moderate	Low	Shallow	Low to moderate	Very severe	Conifers, hardwoods, brush, grass; timber.
Moderately slow	Moderate	Moderately deep	Moderate	Moderate to very severe.	Conifers, hardwoods, brush, grass; timber with some grazing.
Absent	Very low	Very shallow	Low	Very severe	Sparse grass, dense brush, a few conifers; limited range; wildlife, watershed.
Moderate	Moderate	Moderately deep	Low	Slight to severe	Grass-oak; brush; range.
Moderately slow	Moderate	Moderately deep	Low	Slight to moderate	Grass-oak; brush; range.
None	Very low	Very shallow	Low	Severe to very severe.	Sparse conifer-brush, grass; watershed, wildlife.
Moderate to variable.	High	Deep to very deep	High	Occasional flooding.	Grass-forb, a few conifers and hardwoods; pasture, hay.
Slow	Moderate	Moderately deep	Low	None to slight	Grass-forb; range.
Moderate	Low	Shallow	Low to moderate	Very severe	Conifers, hardwoods, brush, grass; timber.
Moderate	Low	Shallow	Low to moderate	Moderate to severe	Conifers, hardwoods, brush, grass; timber.
Moderate	Low	Shallow	Low to moderate	Severe	Conifers, hardwoods, brush, grass; timber.
Moderate	Low	Shallow	Low to moderate	Very severe	Conifers, hardwoods, brush, grass; watershed, wildlife, timber.
Moderate	Low to very low	Shallow	Low to moderate	Severe to very severe.	Dwarfed conifer-brush, hardwoods, grass; timber.
Absent	Very low	Very shallow	Low	Very severe	Sparse grass, dense brush, a few conifers; limited range; wildlife, watershed.

TABLE 8.—*Summary of important*

Map symbol	Name of soil	Drainage class	Runoff class	Permeability
				Surface
MdF	Mariposa-Maymen complex, 51 to 85 percent slopes:			
	Mariposa very rocky loam, 51 to 85 percent slopes	Well drained to somewhat excessively drained.	Very rapid	Moderate
	Maymen very rocky loam, 51 to 85 percent slopes	Somewhat excessively drained.	Very rapid	Moderate
MgE	Maymen very rocky loam, 9 to 51 percent slopes	Somewhat excessively drained.	Very rapid	Moderate
MhE	Maymen-Mariposa complex, 16 to 51 percent slopes:			
	Maymen very rocky loam, 16 to 51 percent slopes	Somewhat excessively drained.	Very rapid to rapid	Moderate
	Mariposa very rocky loam, 16 to 51 percent slopes	Well drained	Rapid to very rapid	Moderate
MlC	McCarthy very cobbly loam, 3 to 16 percent slopes	Well drained	Slow to medium	Moderate
MkE	McCarthy very rocky loam, 16 to 51 percent slopes	Well drained	Medium to very rapid.	Moderate
MkF	McCarthy very rocky loam, 51 to 71 percent slopes	Well drained	Very rapid	Moderate
MmE	McCarthy and Jiggs very cobbly loams, 16 to 51 percent slopes:			
	McCarthy very cobbly loam, 16 to 51 percent slopes	Well drained	Rapid to very rapid	Moderate
	Jiggs very cobbly loam, 16 to 51 percent slopes	Well drained	Medium to rapid	Moderate
Mn	Mine tailings and Riverwash	Excessively drained	Variable	Rapid
Mo	Mixed alluvial land	Mostly well drained, but moderately well drained in some places.	Slow to medium	Moderate to moderately rapid.
Mp	Mixed wet alluvial land	Imperfectly drained to poorly drained.	Slow to very slow	Slow
MrB	Mokelumne sandy loam, 2 to 5 percent slopes	Moderately well drained to well drained.	Medium to rapid	Moderately rapid.
MsD	Mokelumne coarse sandy loam, 5 to 36 percent slopes	Well drained to somewhat excessively drained.	Rapid to very rapid	Rapid
Mt	Mokelumne soils and Alluvial land:			
	Mokelumne sandy loam, 2 to 5 percent slopes	Moderately well drained to well drained.	Medium to rapid	Moderately rapid.
	Alluvial land	Well drained	Slow to medium	Moderate
MvE	Musick very rocky loam, 16 to 51 percent slopes	Well drained	Medium to very rapid.	Moderate
MuB	Musick sandy loam, 3 to 9 percent slopes	Well drained	Slow	Moderate
MuC	Musick sandy loam, 9 to 16 percent slopes	Well drained	Slow to medium	Moderate
MuD	Musick sandy loam, 16 to 31 percent slopes	Well drained	Medium to rapid	Moderate
MuE	Musick sandy loam, 31 to 51 percent slopes	Well drained	Rapid to very rapid	Moderate
MvC	Musick very rocky sandy loam, 9 to 16 percent slopes	Well drained	Slow to medium	Moderate
MvF	Musick very rocky sandy loam, 51 to 71 percent slopes	Well drained	Very rapid	Moderate
MwE	Musick very rocky sandy loam, moderately deep, 16 to 51 percent slopes.	Well drained	Rapid to very rapid	Moderate
MwF	Musick very rocky sandy loam, moderately deep, 51 to 71 percent slopes.	Well drained	Very rapid	Moderate
MxF	Musick extremely rocky sandy loam, moderately deep, 51 to 71 percent slopes.	Well drained	Very rapid	Moderate

qualities of the soils—Continued

Permeability—Con. Subsoil	Available water holding capacity	Effective depth for roots	Natural fertility	Erosion hazard	Dominant natural vegetation and principal uses
Moderate	Low	Shallow	Low to moderate	Very severe	Conifers, hardwoods, brush, grass; watershed, wildlife, timber.
Absent	Low to very low	Very shallow	Low	Very severe	Dwarfed conifers-brush, hardwoods, grass; timber, watershed.
Absent	Very low	Very shallow	Low	Severe to very severe.	Sparse grass, dense brush; limited range; wildlife, watershed.
Absent	Very low	Very shallow	Low	Very severe	Sparse grass, dense brush, a few conifers; limited range; wildlife, watershed.
Moderate	Low to very low	Shallow	Low to moderate	Severe to very severe.	Dwarfed conifers-brush, hardwoods, grass; timber.
Moderate	Moderate	Moderately deep	Moderate to moderately high.	Moderate	Conifers, brush, hardwoods, grass; timber.
Moderate	High	Deep	Moderate to moderately high.	Moderate to very severe.	Conifers, brush, hardwoods, grass; timber.
Moderate	High	Deep	Moderate to moderately high.	Very severe	Conifers, brush, hardwoods, grass; timber.
Moderate	Moderate	Moderately deep	Moderate	Severe to very severe.	Conifers, brush, hardwoods, grass; timber.
Moderate	Moderate	Moderately deep	Moderate	Moderate to severe.	Mixed conifers, brush, grass; timber-range.
Rapid	Variable	Variable	Very low	Most areas subject to flooding.	Edged with hardwoods; a few conifers; little or no grass; livestock watering.
Variable	Moderate to low	Deep	Moderate to high	Subject to flooding.	Edged with hardwoods, conifers; mostly grass-forb; pasture, hay.
Slow to very slow	Moderate to high	Moderately deep to deep.	Moderate	Subject to occasional flooding.	Grass-forb, wiregrass, sedges, range.
Very slow to impermeable.	Low	Shallow to moderately deep.	Very low	Moderate to severe.	Grass and oak of poor quality; range of low quality.
Slow to very slow	Low	Shallow to moderately deep.	Very low	Severe to very severe.	Grass and oak of poor quality; range of low quality.
Very slow to impermeable.	Low	Shallow to moderately deep.	Very low	Moderate to severe.	Grass and oak of poor quality; range.
Moderately slow	Moderate	Very deep	Moderate	Slight	Conifers, hardwoods, brush, grass; timber.
Moderately slow	High to very high	Very deep	Moderate	Very severe	Conifers, hardwoods, brush, grass; timber.
Moderately slow	High to very high	Very deep	Moderate	Moderate	Conifers, hardwoods, brush, grass; timber.
Moderately slow	High to very high	Very deep	Moderate	Moderate to severe.	Conifers, hardwoods, brush, grass; timber.
Moderately slow	High to very high	Very deep	Moderate	Severe to very severe.	Conifers, hardwoods, brush, grass; timber.
Moderately slow	High to very high	Very deep	Moderate	Very severe	Conifers, hardwoods, brush, grass; timber.
Moderately slow	High to very high	Very deep	Moderate	Moderate to severe.	Conifers, hardwoods, brush, grass; timber.
Moderately slow	High to very high	Very deep	Moderate	Very severe	Conifers, hardwoods, brush, grass; timber.
Moderately slow	Moderate	Moderately deep to deep.	Moderate	Very severe	Conifers, hardwoods, brush, grass; timber.
Moderately slow	Moderate	Moderately deep to deep.	Moderate	Very severe	Conifers, hardwoods, brush, grass; timber, watershed, wildlife.
Moderately slow	Moderate	Moderately deep	Moderate	Very severe	Conifers, hardwoods, brush, grass.

TABLE 8.—*Summary of important*

Map symbol	Name of soil	Drainage class	Runoff class	Permeability
				Surface
PaD	Pardee cobbly loam, 3 to 31 percent slopes	Well drained	Slow to rapid	Moderate
PnC	Pentz sandy loam, 2 to 16 percent slopes	Well drained to somewhat excessively drained.	Slow to rapid	Rapid
PnC2	Pentz sandy loam, 9 to 16 percent slopes, eroded	Well drained to somewhat excessively drained.	Medium to rapid	Rapid
PnD	Pentz sandy loam, 16 to 31 percent slopes	Well drained to somewhat excessively drained.	Very rapid	Rapid
PpC	Pentz gravelly sandy loam, 2 to 16 percent slopes	Well drained to somewhat excessively drained.	Medium to rapid	Rapid
PoE	Pentz sandy loam, very shallow, 2 to 51 percent slopes	Somewhat excessively drained.	Medium to very rapid.	Rapid
PrA	Perkins loam, 0 to 3 percent slopes	Well drained	Slow	Moderate
PrC	Perkins loam, 3 to 16 percent slopes	Well drained	Slow to medium	Moderate
PtB	Peters clay, 3 to 9 percent slopes	Moderately well drained to somewhat poorly drained.	Slow to medium	Very slow
Pw	Placer diggings and Riverwash	Variable	Variable	Variable
RbD	Red Bluff-Mokelumne complex, 5 to 16 percent slopes:			
	Red Bluff gravelly loam, 5 to 16 percent slopes	Well drained	Medium to rapid	Moderate
	Mokelumne gravelly sandy loam, 5 to 16 percent slopes.	Moderately well drained	Medium to rapid	Moderate
RbB	Red Bluff-Mokelumne complex, 0 to 5 percent slopes:			
	Red Bluff gravelly loam, 0 to 5 percent slopes	Well drained	Medium	Moderate
	Mokelumne gravelly sandy loam, 0 to 5 percent slopes.	Moderately well drained	Medium	Moderate
RbE2	Red Bluff-Mokelumne complex, 16 to 36 percent slopes, eroded:			
	Red Bluff gravelly loam, 16 to 36 percent slopes, eroded.	Well drained	Rapid to very rapid	Moderate
	Mokelumne gravelly sandy loam, 16 to 36 percent slopes, eroded.	Moderately well drained	Rapid to very rapid	Moderate
RmD	Red Bluff-Mokelumne-Mine pits complex, 2 to 16 percent slopes:			
	Red Bluff gravelly loam, 2 to 16 percent slopes	Well drained	Medium to rapid	Moderate
	Mokelumne gravelly sandy loam, 2 to 16 percent slopes.	Moderately well drained	Medium to rapid	Moderate
	Mine pits			
Ro	Rock land	Excessively drained	Very rapid	Rapid
RyA	Ryer silty clay loam, 0 to 3 percent slopes	Well drained	Slow	Moderate
Sa	Sedimentary rock land	Excessively drained	Very rapid	Rapid
Sb	Serpentine rock land	Excessively drained	Very rapid	Rapid
ScF	Shaver very rocky coarse sandy loam, 51 to 71 percent slopes.	Somewhat excessively drained to well drained.	Rapid	Moderately rapid.
SdF	Shaver very rocky coarse sandy loam, moderately deep, 51 to 71 percent slopes.	Somewhat excessively drained.	Very rapid	Moderately rapid.
SfB	Shenandoah loam, 3 to 9 percent slopes	Moderately well drained to imperfectly drained.	Slow to very slow	Moderate
SgC	Sierra coarse sandy loam, 9 to 16 percent slopes	Well drained	Medium	Moderate
SgB	Sierra coarse sandy loam, 3 to 9 percent slopes	Well drained	Slow to medium	Moderate
SgB2	Sierra coarse sandy loam, 3 to 9 percent slopes, eroded	Well drained	Medium	Moderate

qualities of the soils—Continued

Permeability—Con. Subsoil	Available water holding capacity	Effective depth for roots	Natural fertility	Erosion hazard	Dominant natural vegetation and principal uses
Moderately slow to slow.	Low	Shallow	Low	Moderate to severe.	Grass-oak; range.
Rapid	Low	Shallow	Low	Slight to severe	Grass-oak, brush; range.
Rapid	Low	Shallow	Low	Moderate to severe.	Grass-oak, brush; range.
Rapid	Low	Shallow	Low	Very severe	Grass-oak, brush; range.
Rapid	Low	Shallow	Low	Moderate to severe.	Grass-oak, brush; range.
Rapid	Very low	Very shallow	Low	Moderate to very severe.	Grass-oak, brush; limited range.
Moderately slow to slow.	Moderate to high	Moderately deep to deep.	Low to moderate	Slight	Grass-oak; range.
Moderately slow to slow.	Moderate to high	Moderately deep to deep.	Low to moderate	Moderate	Grass-oak; range.
Very slow	Moderate	Shallow	Low	None to slight	Grass-forb of low quality; range.
Variable	Variable	Variable	Variable	Streambed flooding in most areas.	Edged with hardwoods, some grass-forb; livestock watering.
Slow	Moderate	Moderately deep	Very low	Moderate to severe.	Grass-oak; range.
Very slow	Low	Moderately deep	Very low	Moderate to severe.	Grass-oak; range.
Slow	Moderate	Moderately deep	Very low	None to slight	Grass-oak; range.
Very slow	Low	Moderately deep	Very low	Moderate to severe.	Grass-oak; range.
Slow	Moderate	Moderately deep	Very low	Severe to very severe.	Grass-oak; range.
Very slow	Low	Moderately deep	Very low	Severe to very severe.	Grass-oak; range.
Slow	Moderate	Moderate to deep	Very low	Moderate to severe.	Grass-oak; range.
Very slow	Low	Moderately deep	Very low	Moderate to severe.	Grass-oak; range.
Absent	Very low	Very shallow	Low	Very severe	Sparse grass, conifers, dense brush, a few hardwoods; wildlife, watershed.
Slow to very slow	Moderate	Moderately deep	Moderate to low	None to slight	Grass-forb; range.
Generally absent	Very low	Very shallow	Very low	Very severe	Dense brush; limited range.
Generally absent	Very low	Very shallow	Very low	Very severe	Dense brush; limited range.
Moderately rapid	Moderate	Deep to very deep	Moderate	Very severe	Conifers, hardwoods, brush, grass; timber.
Moderately rapid	Moderate	Deep to moderately deep.	Moderate	Very severe	Conifers, hardwoods, brush, grass; timber.
Slow to very slow	High	Moderately deep	Moderate	Slight to moderate	Grass-oak, a few conifers; range.
Moderately slow	High	Deep to very deep	Moderate	Moderate to severe	Grass-oak, brush, a few conifers; range.
Moderately slow	High	Deep to very deep	Moderate	Moderate	Grass-oak, brush, a few conifers; range.
Moderately slow	High	Deep to very deep	Moderate to low	Moderate to severe	Grass-oak, brush, a few conifers; range.

TABLE 8.—*Summary of important*

Map symbol	Name of soil	Drainage class	Runoff class	Permeability
				Surface
SgC2	Sierra coarse sandy loam, 9 to 16 percent slopes, eroded	Well drained	Medium	Moderate
SgD	Sierra coarse sandy loam, 16 to 31 percent slopes	Well drained	Rapid	Moderate
SgD2	Sierra coarse sandy loam, 16 to 31 percent slopes, eroded	Well drained	Rapid	Moderate
SkD	Sierra very rocky coarse sandy loam, 16 to 31 percent slopes.	Well drained	Rapid	Moderate
SkF	Sierra very rocky coarse sandy loam, 51 to 71 percent slopes.	Well drained	Very rapid	Moderate
ShB	Sierra coarse sandy loam, moderately deep, 3 to 9 percent slopes.	Well drained	Medium	Moderate
ShB2	Sierra coarse sandy loam, moderately deep, 3 to 9 percent slopes, eroded.	Well drained	Medium	Moderate
ShC	Sierra coarse sandy loam, moderately deep, 9 to 16 percent slopes.	Well drained	Medium to rapid	Moderate
ShC2	Sierra coarse sandy loam, moderately deep, 9 to 16 percent slopes, eroded.	Well drained	Medium to rapid	Moderate
ShD	Sierra coarse sandy loam, moderately deep, 16 to 31 percent slopes.	Well drained	Rapid	Moderate
ShD2	Sierra coarse sandy loam, moderately deep, 16 to 31 percent slopes, eroded.	Well drained	Rapid	Moderate
SmD	Sierra very rocky coarse sandy loam, moderately deep, 9 to 31 percent slopes.	Well drained	Medium to rapid	Moderate
SmE	Sierra very rocky coarse sandy loam, moderately deep, 31 to 51 percent slopes.	Well drained	Very rapid	Moderate
SlD3	Sierra sandy clay loam, 9 to 31 percent slopes, severely eroded.	Well drained	Rapid to very rapid	Moderately slow.
SrE	Sites very rocky loam, 16 to 51 percent slopes	Well drained	Medium to very rapid.	Moderate
SnB	Sites loam, 3 to 9 percent slopes	Well drained	Slow	Moderate
SnC	Sites loam, 9 to 16 percent slopes	Well drained	Slow to medium	Moderate
SnD	Sites loam, 16 to 31 percent slopes	Well drained	Medium to rapid	Moderate
SnE	Sites loam, 31 to 51 percent slopes	Well drained	Rapid	Moderate
SrC	Sites very rocky loam, 3 to 16 percent slopes	Well drained	Slow to medium	Moderate
SrF	Sites very rocky loam, 51 to 85 percent slopes	Well drained	Very rapid	Moderate
SoC	Sites loam, moderately deep, 3 to 16 percent slopes	Well drained	Slow to medium	Moderate
SoD	Sites loam, moderately deep, 16 to 31 percent slopes	Well drained	Rapid	Moderate
SoE	Sites loam, moderately deep, 31 to 51 percent slopes	Well drained	Very rapid	Moderate
SpD3	Sites clay loam, moderately deep, 3 to 31 percent slopes, severely eroded.	Well drained	Medium to rapid	Moderately slow.
SsE	Sites very rocky loam, moderately deep, 16 to 51 percent slopes.	Well drained	Rapid to very rapid	Moderate
StE	Sites-Mariposa complex, 16 to 51 percent slopes:			
	Sites very rocky loam, moderately deep, 16 to 51 percent slopes.	Well drained	Rapid to very rapid	Moderate
	Mariposa very rocky loam, 16 to 51 percent slopes	Well drained	Rapid to very rapid	Moderate
SwD	Snelling sandy loam, 9 to 16 percent slopes	Well drained	Medium to rapid	Moderately rapid.
SwE	Snelling sandy loam, 16 to 31 percent slopes	Well drained	Rapid	Moderately rapid.
SvA	Snelling fine sandy loam, 0 to 2 percent slopes	Well drained	Slow	Moderately rapid.
SvB	Snelling fine sandy loam, 2 to 5 percent slopes	Well drained	Slow to medium	Moderately rapid.
SvC	Snelling fine sandy loam, 5 to 9 percent slopes	Well drained	Medium	Moderately rapid.

qualities of the soils—Continued

Permeability—Con. Subsoil	Available water holding capacity	Effective depth for roots	Natural fertility	Erosion hazard	Dominant natural vegetation and principal uses
Moderately slow	High	Deep to very deep	Moderate to low	Moderate to severe	Grass-oak, brush, a few conifers; range.
Moderately slow	High	Deep to very deep	Moderate	Severe	Grass-oak, brush, a few conifers; range.
Moderately slow	High	Deep to very deep	Moderate to low	Severe	Grass-oak, brush, a few conifers; range.
Moderately slow	High	Deep to very deep	Moderate	Severe	Some conifers on north slopes, grass, forbs; range.
Moderately slow	High	Deep to very deep	Moderate	Very severe	Some conifers on north slopes, grass, forbs; range.
Moderately slow	Moderate	Deep to moderately deep.	Moderate	Moderate	Grass-forb; range.
Moderately slow	Moderate	Moderately deep	Moderate to low	Moderate to severe.	Grass-forb; range.
Moderately slow	Moderate	Deep to moderately deep.	Moderate	Moderate to severe.	Grass-forb; range.
Moderately slow	Moderate	Moderately deep	Moderate to low	Severe	Grass-forb; range.
Moderately slow	Moderate	Moderately deep	Moderate	Severe	Grass-forb; range.
Moderately slow	Moderate	Moderately deep	Moderate to low	Severe to very severe.	Grass-forb; range.
Moderately slow	Moderate	Moderately deep	Moderate	Moderate to severe.	Grass-forb; range.
Moderately slow	Moderate	Moderately deep	Moderate	Very severe	Grass-forb, conifers in places; range.
Moderately slow	Moderate	Moderately deep	Low	Severe	Grass-oak, brush, a few conifers; range.
Moderately slow	Very high to high	Deep	Moderate	Severe to very severe.	Conifers, hardwoods, brush, grass; timber.
Moderately slow	Very high to high	Deep	Moderate	Slight	Conifers, hardwoods, brush, grass; timber.
Moderately slow	Very high to high	Deep	Moderate	Moderate	Conifers, hardwoods, brush, grass; timber.
Moderately slow	Very high to high	Deep	Moderate	Severe	Conifers, hardwoods, brush, grass; timber.
Moderately slow	Very high to high	Deep	Moderate	Very severe	Conifers, hardwoods, brush, grass; timber.
Moderately slow	Very high to high	Deep	Moderate	Slight to moderate	Conifers, hardwoods, brush, grass; timber.
Moderately slow	Very high to high	Deep	Moderate	Very severe	Conifers, hardwoods, brush, grass; timber.
Moderately slow	Moderate	Moderately deep	Moderate	Moderate	Conifers, hardwoods, brush, grass; timber.
Moderately slow	Moderate	Moderately deep	Moderate	Severe	Conifers, hardwoods, brush, grass; timber.
Moderately slow	Moderate	Moderately deep	Moderate	Very severe	Conifers, hardwoods, brush, grass; timber.
Moderately slow	Moderate to low	Moderately deep	Low	Severe	Conifers, hardwoods, brush, grass; timber.
Moderately slow	Moderate	Moderately deep	Moderate	Severe to very severe.	Conifers, hardwoods, brush, grass; timber.
Moderately slow	Moderate	Moderately deep	Moderate	Severe to very severe.	Conifers, hardwoods, brush, grass; timber.
Moderate	Low to very low	Shallow	Low to moderate	Severe to very severe.	Dwarfed conifer-brush, hardwoods, grass; timber.
Moderate to moderately slow.	Moderate	Deep	Moderate	Moderate to severe.	Grass-oak; range.
Moderate to moderately slow.	Moderate	Deep	Moderate	Severe	Grass-oak; grazing.
Moderate	High	Very deep	Moderate to high	Slight	Grass-oak; hay, grain.
Moderate	High	Very deep	Moderate to high	Slight to moderate	Grass-oak; hay, grain.
Moderate	High	Very deep	Moderate to high	Moderate	Grass-oak; hay, grain.

TABLE 8.--*Summary of important*

Map symbol	Name of soil	Drainage class	Runoff class	Permeability
				Surface
SuB	Snelling loam, moderately well drained, 0 to 9 percent slopes.	Moderately well drained to imperfectly drained.	Medium	Moderate
SxD	Supan cobbly loam, 3 to 31 percent slopes	Well drained	Slow to rapid	Moderate
SyE	Supan very cobbly loam, moderately deep, 31 to 51 percent slopes.	Well drained	Very rapid	Moderate
SyD	Supan very cobbly loam, moderately deep, 3 to 31 percent slopes.	Well drained	Medium to very rapid.	Moderate
TcE	Tiger Creek very rocky loam, 16 to 51 percent slopes	Well drained	Rapid to very rapid	Moderate
WcE	Windy cobbly sandy loam, 16 to 51 percent slopes	Well drained to somewhat excessively drained.	Rapid to very rapid	Moderately rapid to moderate.
WcD	Windy cobbly sandy loam, 9 to 16 percent slopes	Well drained to somewhat excessively drained.	Medium	Moderately rapid to moderate.

Ahwahnee Series

The Ahwahnee series consist of brown, well-drained to somewhat excessively drained, mostly moderately deep soils formed from weathered granitic rock. These soils occur at elevations of 1,100 to 2,000 feet in the upper part of foothills near the Shenandoah Valley. They are gently sloping to steep. The vegetation is mainly grass and oak but includes some scattered conifers and brush.

The surface soil is brown, friable loam or fine sandy loam that is porous and slightly hard when dry. The subsoil is slightly finer textured than the surface soil. It is brown to light reddish-brown loam or heavy loam and is plastic and slightly sticky when wet. The soil is massive and is medium acid throughout the profile. Weathered bedrock is at a depth of 15 to 36 inches. The underlying material is mostly brown, grayish-brown or reddish-brown granodiorite.

The zone of weathering in the bedrock ranges from 2 to 10 feet, and the weathered material is fractured and is somewhat pervious to moisture and roots. In some places the soils are nearly free of rock, but in other places there are loose rock fragments throughout the profile and rock outcrops on the surface.

Most areas of Ahwahnee soils contain areas of other soils that are too small to be mapped separately or are transitional in nature. Up to 10 percent of some areas mapped as Ahwahnee soils have a brown or yellowish-red surface layer and a subsoil of red loam or clay loam similar to that of the Sierra soils. In swales and drainageways that are wet much of the year, there are soils commonly mottled with pale brown and grayish brown that are similar to those of the Shenandoah and Snelling series.

Ahwahnee soils are used mostly for grazing, but some areas are used periodically for hay and grain crops, and a small acreage is in vineyards.

Ahwahnee very rocky loam, 9 to 31 percent slopes (AdD).—This gently sloping to strongly sloping soil, the most extensive of the Ahwahnee series, is in hilly areas.

Representative profile under grass and oak:

0 to 16 inches, brown loam; massive; slightly hard when dry, friable when moist, slightly sticky and slightly plastic when wet; many pores; medium acid.

16 to 27 inches, loam to heavy loam that is similar to the surface soil but slightly higher in clay content and plastic and slightly sticky when wet.

27 to 32 inches, light-brown loam with flecks of pink; massive; hard when dry, friable when moist, slightly sticky and slightly plastic when wet; medium acid.

32 to 36 inches +, bedrock of weathered granodiorite; medium acid.

The surface soil ranges from brown to grayish brown in color, and from loam to fine sandy loam in texture. Depth to weathered bedrock ranges from 20 to 36 inches. Rock outcrops cover from 2 to 15 percent of the surface area.

This soil is well drained. The permeability, available water holding capacity, and natural fertility are moderate. Root penetration is moderately deep to deep. Runoff is medium to rapid, and the erosion hazard is moderate to severe. Rock outcrops generally restrict cultivation.

This soil is used mostly for grazing, but some gently sloping areas are periodically planted to hay or grain and then allowed to revert to range. Under good management the range is fairly productive. Yields of forage increase if fertilizer that contains nitrogen and phosphate is applied and if sulfur is added occasionally. Capability unit VIs-1(18); range site 3.

Ahwahnee loam, 3 to 9 percent slopes (AaB).—This soil, one of the best in the Ahwahnee series, consists of areas in swales and on concave slopes. The total acreage is small. The soil is fairly free of rocks and less sloping than Ahwahnee very rocky loam, 9 to 31 percent slopes, but it is otherwise similar to that soil.

Ahwahnee loam, 3 to 9 percent slopes, is easy to cultivate. Runoff is slow to medium, and the erosion hazard is moderate.

Although this soil is used mostly for grazing, some areas are used for dry-farmed hay and grain crops and a small acreage is planted to vineyards. This soil erodes

qualities of the soils—Continued

Permeability—Con. Subsoil	Available water-holding capacity	Effective depth for roots	Natural fertility	Erosion hazard	Dominant natural vegetation and principal uses
Moderately slow	High	Deep	Moderate	Slight to moderate, occasional flooding.	Grass-oak; dryland pasture.
Moderately slow	High	Deep	Moderate	Slight to severe	Annual grass and forbs; range.
Moderately slow	Moderate	Moderately deep	Moderate	Very severe	Grass-oak; range.
Moderately slow	Moderate	Moderately deep	Moderate	Moderate to very severe.	Grass-oak; range.
Moderately slow	Moderate	Moderately deep	Moderate	Very severe	Conifers, hardwoods, brush, grass; timber.
Moderately rapid	Low to moderate	Deep to moderately deep.	Moderate	Severe to very severe.	Conifer-brush, hardwoods; timber.
Moderately rapid	Low to moderate	Deep to moderately deep.	Moderate	Moderate to severe.	Conifer-brush, hardwoods; timber.

if it is left finely tilled before the rainy season. It should be protected by adequate vegetation. Capability unit IIIe–8(18); range site 3.

Ahwahnee loam, 3 to 9 percent slopes, eroded (AaB2).—This soil is similar to other nonrocky soils of the Ahwahnee series, except that it has been cropped in the past and is now moderately eroded. Some areas have lost the entire surface layer and are rilled. Vines standing on pedestals in remnants of old vineyards are common in places.

The available water holding capacity is low to moderate, root penetration is moderately deep, and natural fertility is low to moderate. Runoff is slow to medium, and the erosion hazard is moderate.

This soil is used mostly for grazing. The range is in poor condition and commonly is invaded by the less desirable forage plants. The areas should be grazed lightly to permit reestablishment of the better grasses. Reseeding bare spots and applying fertilizer hasten restoration of the range. Capability unit IIIe–8(18); range site 3.

Ahwahnee loam, 9 to 16 percent slopes (AaC).—This strongly sloping soil is in hilly areas that have only a few rock outcrops. Its profile is similar to that of Ahwahnee very rocky loam, 9 to 31 percent slopes. Runoff is medium to rapid, and the erosion hazard is moderate to severe.

Although this soil is used mostly for annual range, some areas are used for dry-farmed hay and grain crops, and a small acreage is planted to vineyards. Tilling across the slope and leaving straw and other plant residues on the surface as a mulch in grainfields are practices that help to control erosion. On long slopes, stripcropping or diversion terraces may be needed to slow runoff. Capability unit IVe–8(18); range site 3.

Ahwahnee loam, 9 to 16 percent slopes, eroded (AaC2).—This soil is in rolling, hilly areas. Except that it has formerly been cropped and is now eroded, it is similar to Ahwahnee very rocky loam, 9 to 31 percent slopes. In some places the surface soil is very thin, and in others all of it has been lost. Gullies and rills are evident in some places. Root penetration is moderately deep, and natural fertility is moderate to low. Runoff is medium to rapid, and the erosion hazard is moderate to severe.

Formerly, this soil was used mainly for dry-farmed hay and grain, but it is now used largely for grazing. A few areas are in poorly producing vineyards or in abandoned vineyards that have mostly reverted to range. The range is in poor condition and generally has been invaded by less desirable grasses and weeds. Yields of forage increase if the bare spots are seeded to more productive grasses and legumes and fertilizer is applied. Erosion is severe if this soil is cultivated. Consequently, when the soil is used for cultivated crops, practices that control erosion are needed. Also, the soil should not be left bare, especially during the rainy season. Capability unit IVe–8(18); range site 3.

Ahwahnee loam, 16 to 31 percent slopes (AaD).—This moderately steep soil is on rounded hills. It is fairly free of rocks, but its profile is otherwise similar to that of other Ahwahnee soils. The available water holding capacity is moderate, root penetration is moderately deep to deep, and natural fertility is moderate. Runoff is rapid, and the erosion hazard is severe.

Because of the hazard of erosion, this soil is used mostly for range, and it can be kept productive if it is well managed. Thinning the stands of oak and brush helps to increase yields of forage. Capability unit VIe–1(18); range site 3.

Ahwahnee loam, 16 to 31 percent slopes, eroded (AaD2).—Most of the surface layer of this soil has been removed through erosion, and rills and gullies are evident. The available water holding capacity is low to moderate, root penetration is moderately deep, and natural fertility is moderate to low. Runoff is rapid, and the erosion hazard is severe to very severe.

This soil is used mostly for grazing, and the range is generally in poor condition. The areas should be grazed lightly. Reseeding of bare spots and applying fertilizer

may be needed to help restore areas that have badly deteriorated. Capability unit VIe–1(18); range site 3.

Ahwahnee very rocky loam, 16 to 31 percent slopes, severely eroded (AdD3).—This moderately steep soil is in hilly areas that have been dissected by erosion. In some places most of the surface layer and as much as 25 percent of the subsoil have been removed through erosion. Here the soil is deeply gullied and in places bedrock is exposed. The available water holding capacity is low, root penetration is moderately deep to shallow, and natural fertility is low. Runoff is very rapid, and the erosion hazard is very severe.

If this soil is cultivated, it is subject to further erosion. The areas were once cultivated but are now used for grazing. The range is in poor condition. Productivity is difficult to restore because of the numerous gullies and rock outcrops. Some areas can be tilled lightly to prepare a partial seedbed, and seeded. Applying fertilizer helps restore fertility. The areas should be grazed lightly until vegetation is established. Capability unit VIIs–1(18); range site 3.

Ahwahnee very rocky loam, 31 to 51 percent slopes (AdE).—This soil is on steep hills and sharp breaks that drop down to major streams. In places from 2 to 15 percent of the surface area consists of rock outcrops. There are stands of ponderosa pine and other conifers in places on north slopes and at the upper limits of elevation. Depth to bedrock ranges from 15 to more than 48 inches.

The available water holding capacity is moderate, root penetration is moderately deep to deep, and natural fertility is moderate. Runoff is very rapid, and the erosion hazard is very severe.

In places the soil has a red or reddish-brown subsoil and is similar to the Musick soils. As much as 7 percent of this mapping unit in forested areas consists of deep, reddish-brown soils that have a subsoil of red clay loam. Also included are small areas of deep, grayish-brown or pale-brown soils.

Ahwahnee very rocky loam, 31 to 51 percent slopes, is used mainly for grazing, but in some places it is also used for timber. Areas used as range are too steep and rocky for reseeding with ordinary farm machinery. The stands of conifers can be used for timber. Capability unit VIIs–1(18); range site 3.

Ahwahnee extremely rocky loam, 9 to 51 percent slopes (AfD).—This moderately sloping to steep soil is in hilly and mountainous areas. In places rock outcrops cover from 30 to 60 percent of the surface. Runoff is medium to very rapid, and the erosion hazard is moderate to very severe.

Rocks and steep slopes restrict the use of this soil to grazing. Capability unit VIIs–7(18); range site 5.

Ahwahnee very rocky loam, shallow, 16 to 51 percent slopes (AeE).—This moderately steep to steep soil is in hilly areas and is only 10 to 24 inches deep over bedrock. The surface soil is more grayish brown than that of other Ahwahnee soils. In places it is sandy loam and is 4 to 6 inches thick. The subsoil is sandy loam or loam and is 8 to 10 inches thick. From 2 to 15 percent of the surface area consists of rock outcrop.

This soil is well drained to somewhat excessively drained. The available water holding capacity is low, root penetration is shallow to moderately deep, and natural fertility is moderate. Runoff is rapid to very rapid, and the erosion hazard is severe to very severe.

This soil is used primarily for grazing and is less productive than the other Ahwahnee very rocky loams. Forage matures early on this soil and dries up when the first extended warm period occurs in spring. Although yields increase slightly if the areas are reseeded and fertilizer is applied, the increase may not warrant the cost. On this soil, timber grows in pockets on some of the slopes. Capability unit VIs–49(18); range site 6.

Aiken Series

The Aiken series consists of well-drained, deep and very deep, cobbly soils. These soils formed mainly in material weathered from volcanic conglomerate but partly in material from intrusive igneous rock. They are at elevations of 2,000 to 4,800 feet on gently sloping, wide, smooth ridges and on steeper adjoining side slopes. Conifers, hardwoods, brush, and grass make up the vegetation.

The surface soil is dark-brown to reddish-brown loam and is slightly acid to medium acid. Under native forest it is very friable and in good tilth. The upper part of the subsoil is reddish-brown clay loam. The clay content increases with increasing depth. The middle and lower parts of the subsoil are yellowish-red to brown clay that is dark red or reddish brown when moist and takes in water well. The subsoil is medium acid to very strongly acid. The parent material is predominantly weathered volcanic cobblestones cemented with a matrix of tuffaceous clay. Consolidated conglomerate occurs at a depth of 5 to 9 feet or more. In most places the profile contains some cobblestones and other stones that are dominantly between 5 and 16 inches in diameter.

Aiken soils are used mostly for timber. Some areas are grazed, and a small acreage is in orchards of apples and walnuts.

Aiken cobbly loam, 3 to 16 percent slopes (AkC).—This soil, the most extensive of the Aiken series, is on smooth ridgetops and strongly sloping side slopes. The slope is dominantly less than 9 percent, but in some places it is as much as 16 percent.

Representative profile under conifers and browse:

2 inches or less of fresh pine needles, twigs, and leaves from hardwoods; the litter is decomposing in the lower part.
0 to 24 inches, reddish-brown cobbly loam; granular structure; soft when dry, very friable when moist; slightly acid to medium acid; many iron and manganese beads one-eighth of an inch in diameter.
24 to 37 inches, reddish-brown cobbly clay loam; weak, granular structure; slightly hard when dry, friable when moist; medium acid; many beads of iron and manganese.
37 to 59 inches, yellowish-red cobbly clay; massive; hard when dry, firm when moist, plastic and sticky when wet; medium acid; many beads of iron and manganese.
59 to 92 inches, brown cobbly clay that becomes yellowish brown with increasing depth; massive; hard to very hard when dry, firm when moist, plastic and sticky when wet; medium acid; a few beads of iron and manganese.
92 inches +, bedrock of weathered andesitic tuff and cobblestones.

The surface layer ranges from 15 to 30 inches in thickness, and the subsoil from 50 to 70 inches. Much of the soil mass in the lower part of the profile can be picked up by a small magnet when the soil is crushed. Rounded andesitic cobblestones, mostly 5 to 16 inches in diameter, make up 10 to 30 percent of the profile. Generally, the number of cobblestones increases with increasing depth. About 5 percent of the acreage consists of very cobbly

loams that have a subsoil of dark-red to yellowish-red clay loam.

Aiken cobbly loam, 3 to 16 percent slopes, is well drained. Permeability is moderate in the surface soil and moderately slow in the subsoil. The water-holding capacity is very high, root penetration is very deep, and fertility is moderate. Runoff is slow to medium, and the erosion hazard is slight to moderate.

This is one of the best soils in the Area for timber, and under good management it produces stands of trees that grow rapidly and are of high quality. The climate and the numerous cobblestones limit the use of the soil for cultivated crops. In small areas the cobblestones have been removed by hand and the soils planted to orchards of apples, pears, and walnuts. Yields of these crops increase if fertilizer that contains nitrogen and phosphate is applied. Capability unit IVs–7(22); woodland suitability group 1.

Aiken loam, 3 to 9 percent slopes (AhB).—This soil, one of the best in the Aiken series, is on plateaulike ridges. Generally, it is less sloping than Aiken cobbly loam, 3 to 16 percent slopes, and contains only a few cobblestones, mainly less than 16 inches in diameter, but it is otherwise similar to that soil. Runoff is slow, and the erosion hazard is slight.

In some places the cover of plants has been destroyed by fire, and in other places the soil has been cleared and cropped. These areas are eroded, contain rills and small gullies, and are generally invaded by mountain misery, a low-growing shrub.

Figure 15.—**Apple orchard on an Aiken loam in the background; in the foreground is pasture on Mixed wet alluvial land.**

Lack of irrigation water limits the use of Aiken loam, 3 to 9 percent slopes. According to local history, this soil was used for pears, apples, peaches, prunes, walnuts, and other crops when irrigation water was available from mining ditches. In some areas dry-farmed hay and grain were grown. This soil is now used mainly for timber, but a small acreage is dry-farmed to orchard, grain, and hay crops (fig. 15). Areas that were cleared are used mostly for dry pasture and are slowly reverting to brush and timber. Capability unit IIe–1(22); woodland suitability group 1.

Aiken loam, 9 to 16 percent slopes (AhC).—This soil is on side slopes of ridges. It has a few cobblestones in the profile, but it is otherwise similar to Aiken cobbly loam, 3 to 16 percent slopes. Runoff is slow to medium, and the erosion hazard is moderate.

Small areas of this mapping unit consist of very cobbly loam that has a subsoil of dark-red or yellowish-red clay loam. In places soil material from areas of this soil moves downhill and covers areas of other soils.

Aiken loam, 9 to 16 percent slopes, is used largely for timber, but a small acreage is planted to apple and walnut trees, and some cleared areas are used for grazing. Generally, cobblestones are not numerous enough to hinder tillage. Capability unit IIIe–1(22); woodland suitability group 1.

Aiken cobbly loam, 16 to 31 percent slopes (AkD).—This moderately steep soil is on side slopes. The surface soil ranges from 12 to 18 inches in thickness. In most places the subsoil is clay, but in some places it is less developed and is more nearly heavy clay loam. Depth to weathered conglomerate ranges from 56 to 70 inches and is generally less than that of other Aiken soils. Generally, rounded andesitic cobblestones, mostly 5 to 16 inches in diameter, occupy 5 to 25 percent of the profile, but a few areas are nearly free of cobblestones. Runoff is medium to rapid, and the erosion hazard is moderate to severe.

In some places reddish-brown soils derived from slate and igneous rock are on foot slopes below this soil, and in places they are mantled by material that washed or rolled from this soil. In some small areas this soil is very cobbly.

Aiken cobbly loam, 16 to 31 percent slopes, is used mostly for timber. Only a small acreage is used for family apple orchards, walnut orchards, or dryland pasture. Capability unit VIs–1(22); woodland suitability group 2.

Aiken cobbly loam, 31 to 51 percent slopes (AkE).—This steep soil is on side slopes and ridges, but it is otherwise similar to Aiken cobbly loam, 3 to 16 percent slopes. Runoff is rapid, and the erosion hazard is severe.

In small areas the soil is shallow and very cobbly. In some places colluvium from this soil covers areas of other soils downhill that are reddish brown and that formed in material from slate and igneous rock.

Aiken cobbly loam, 31 to 51 percent slopes, is used solely for timber and for summer grazing. It is too steep for cultivation, and the cobblestones in it interfere with tillage. This soil is likely to erode if it is poorly managed and if logging is carelessly done. Capability unit VIs–1(22); woodland suitability group 3.

Aiken very rocky loam, 16 to 51 percent slopes (AmE).—This moderately steep to steep soil is in slightly convex areas. It formed in material derived from nearly black, basic igneous rock. The surface layer is yellowish-red to red loam that is slightly acid and is granular and slightly hard when dry. The subsoil is red clay that has subangular blocky structure and is hard when dry. The profile is more yellowish with increasing depth and is micaceous throughout. In places rock outcrops occupy from 5 to 30 percent of the surface area. The soil is well drained. Runoff is medium to rapid, and the erosion hazard is moderate to very severe.

This soil is used for timber and for grazing. If it is well managed, good stands of trees that grow rapidly and are of high quality can be produced. Capability unit VIs–1(22); woodland suitability group 3.

Aiken very rocky loam, 51 to 71 percent slopes (AmF).—This very steep soil is on side slopes of river canyons. It is steeper but is otherwise similar to Aiken very rocky loam, 16 to 51 percent slopes. Runoff is very rapid; and the erosion hazard is very severe.

This soil is used solely for timber and light grazing. Because of the steep slopes, special practices are needed when logging is done. Capability unit VIIs-1(22); woodland suitability group 4.

Alluvial Land

Alluvial land consists mostly of pale-brown to light-gray sandy loam that is well drained to moderately well drained. It is underlain at a depth of 15 to 25 inches by a substratum of sandy clay loam to sandy clay. Alluvial land is commonly stratified with fine sandy loam to silty clay loam and in places contains quartz gravel. It is medium acid to strongly acid and low in fertility. It is mapped only as an undifferentiated unit with the Mokelumne soils. Capability unit IVw-2(18); range site 1.

Argonaut Series

In the Argonaut series are moderately well drained, shallow to moderately deep soils formed in material weathered from metabasic igneous rock. These soils are gently sloping to moderately steep. They are on foothills at elevations from 500 to 1,600 feet. They occupy a belt that extends from the Mokelumne River northward and roughly parallels State Highway No. 49. The vegetation is mostly grass and oak, but it includes thin to dense stands of brush and a few digger pines.

The surface soil is brown to yellowish-red gravelly loam or silt loam; it is friable and slightly acid. The subsoil is yellowish-red, brown, or yellowish-brown heavy clay. It is sticky and very plastic and slightly acid to medium acid. A lens of hard, broken stone occurs between the surface soil and the subsoil. Underlying the subsoil, at a depth between 18 and 30 inches, is weathered greenstone.

Except that the surface soil is weakly platy in places, the profile is massive throughout. In some places the surface is fairly free of rock outcrop. In most places, however, the profile contains gravel or cobblestones. In places these stones make up as much as 25 percent of the soil mass, by volume.

Argonaut soils are used chiefly for range, but a small acreage is used for vineyards and irrigated pasture. Occasionally, hay and grain crops are grown on a small acreage.

Argonaut very rocky loam, 3 to 31 percent slopes (AoD).—This undulating to strongly sloping soil is in hilly areas.

Representative profile under annual range and oak trees:

0 to 2 inches, brown gravelly loam; very weak platy structure; hard when dry, friable when moist; slightly acid.
2 to 6 inches, yellowish-red gravelly heavy loam; massive; hard when dry, friable when moist; slightly acid.
6 to 10 inches, yellowish-red gravelly heavy clay loam; massive; hard when dry, friable when moist, slightly sticky and plastic when wet; slightly acid.
10 to 14 inches, yellowish-red clay; massive; very hard when dry, sticky and plastic when wet; slightly acid.
14 to 21 inches, brown clay; massive; very hard when dry, firm when moist, sticky and very plastic when wet; a few slickensides; slightly acid.
21 to 27 inches, light yellowish-brown, deeply weathered, metaandesite; occasional black stains along fracture planes; crumbles when disturbed but becomes hard with increasing depth.

At a depth between 10 and 14 inches, a lens of hard, broken stone occurs near the upper boundary.

From 5 to 25 percent of the surface area consists of rock outcrops, and the soil contains from 15 to 25 percent of rock fragments, by volume. The surface layer ranges from brown to yellowish red and in some places is slightly mottled. The subsoil ranges from yellowish red to olive yellow and from slightly acid to medium acid. Depth to weathered bedrock ranges from 18 to 30 inches. Tongues of clay extend into the weathered bedrock.

This soil is moderately well drained. Permeability of the surface layer is moderate, and that of the subsoil is very slow. The available water holding capacity is moderate, root penetration is shallow to moderately deep, and fertility is moderate. Runoff is medium to rapid, and the erosion hazard is moderate to severe.

Included with this soil in mapping are areas of Auburn silt loam, which are interspersed within areas of this soil and in places make up as much as 20 percent of the acreage. The Auburn soils have a surface layer similar to that of the Argonaut soils, but their subsoil is silt loam. Also included are small areas of Auburn or Exchequer very rocky silt loam, which are mostly underlain by slate.

The surface layer of Argonaut very rocky loam, 3 to 31 percent slopes, is saturated quickly, particularly during heavy rains. In some places roots penetrate the subsoil by following cracks in the clay and extend into cleavages in the bedrock. The roots extract some moisture from the clay.

Rock outcrops and rocks in the profile interfere with tillage, and this soil is therefore used mostly for range. Small, gently sloping areas are tilled occasionally and planted to hay and grain. In some places there are remnants of perennial grasses. Wiregrass and sedges are plentiful, especially in wet years.

This soil is generally slightly less productive than the closely associated Auburn soils. Range plants and hay and grain crops are likely to drown out in years of excessive rainfall. Capability unit VIs–4(18); range site 2.

Argonaut gravelly loam, 3 to 31 percent slopes (AnD).—Most areas of this soil are on hills where the slope is less than 16 percent, but in small areas the slope is as much as 31 percent. Except for having few or no rock outcrops, this soil is similar to Argonaut very rocky loam, 3 to 31 percent slopes.

In places about 20 percent of the acreage of this soil consists of Auburn silt loam or of small scattered areas of Whiterock or Eldorado loam. Also included are small areas of claypan soils derived from metasedimentary rock.

Argonaut gravelly loam, 3 to 31 percent slopes, is used mostly for grazing, but hay and grain crops are grown occasionally in some areas. Yields of forage increase if more desirable kinds of range plants, including perennials, are seeded and fertilizer that contains nitrogen or phosphate is added. Capability unit IVe–3(18); range site 2.

Auburn Series

The soils in the Auburn series are well drained and shallow to moderately deep. These soils formed in metabasic igneous rock and metasedimentary rock. They are

nearly level to very steep and are in foothills at elevations of 500 to 1,200 feet. The vegetation is mainly grass-oak and scattered digger pines, but there is a dense stand of brush on a small acreage.

The surface soil is brown, strong-brown, reddish-brown, or yellowish-brown loam or silt loam that is friable and slightly acid to medium acid. It is mostly massive, but in places it is granular. The subsoil is yellowish-red, reddish-brown, or brown heavy loam or clay loam that is massive or blocky and slightly acid to medium acid. Depth to weathered bedrock ranges from 10 to 40 inches. In places rock outcrops occupy from 5 to 40 percent of the surface area and gravel and cobblestones make up as much as 25 percent of the soil mass. Some areas are comparatively free of rock.

Auburn soils, the most extensive in the Area, are used primarily for the grazing of cattle. Occasionally, dry-farmed hay and grain crops are grown. In places Auburn soils are so intermingled with the Argonaut soils that they are mapped together as a complex. In other places Auburn soils are closely associated with the Exchequer soils and are mapped with them as an undifferentiated unit.

Auburn very rocky silt loam, 3 to 31 percent slopes (AsD).—This gently sloping to steep soil, the most extensive of the Auburn series, is in undulating to hilly areas. From 5 to 20 percent of the surface area is occupied by rock outcrops.

Representative profile under annual range:

0 to 9 inches, strong-brown silt loam; massive; slightly hard when dry, friable when moist; slightly acid.
9 to 14 inches, yellowish-red silt loam; massive; hard when dry, friable when moist; slightly acid.
14 inches +, weathered, very pale brown, amphibolite schist.

The surface soil ranges from dark reddish brown or strong brown to yellowish red. Its texture is loam in places. The subsoil ranges from heavy loam or silt loam to light clay loam. Depth to bedrock ranges from 12 to 22 inches.

This soil is well drained. Permeability of the surface soil is moderate, and that of the subsoil is moderate to moderately slow. The available water holding capacity is moderate to low, root penetration is shallow, and fertility is moderate. Runoff is medium to very rapid, and the erosion hazard is moderate to very severe.

This soil is the most extensive soil used for range in the Area. It is commonly called strong grass country by ranchers because stock do well on it. This soil has slopes moderate enough for uniform grazing, but good management is necessary to maintain its productivity. Annual grasses and forbs respond well if fertilizer that contains nitrogen and phosphate is applied. Capability unit VIs–4(18); range site 2.

Auburn silt loam, 0 to 31 percent slopes (ApD).—This soil is similar to Auburn very rocky silt loam, 3 to 31 percent slopes, but is relatively free of rock outcrops. It is nearly level to moderately steep, but slopes are mostly less than 16 percent. Runoff is slow to very rapid. The erosion hazard is very severe.

This soil is used predominantly for range, but small areas are used for hay and grain crops. Range that has deteriorated can be improved by seeding more productive kinds of plants and applying fertilizer. Capability unit IVe–4(18); range site 2.

Auburn very rocky silt loam, 3 to 9 percent slopes, eroded (AsB2).—This gently sloping to moderately sloping soil is on hills in the northwestern part of the Area. Most areas have a thin gravelly cap on the surface that has been disturbed through placer mining. Small mounds of soil material left by ground sluicing are on the surface, and the soil is somewhat gullied. Interspersed between the mounds are large areas that are relatively untouched. From 5 to 20 percent of the surface consists of rock outcrops. In most places the vegetation has reverted to grass-oak. This soil is well drained. Runoff is medium, and the erosion hazard is moderate.

The acreage of this soil is small, and most of it is used for grazing. Because of the hummocky relief and rock outcrops, this soil is not suitable for cultivation. Capability unit VIs–4(18); range site 2.

Auburn very rocky silt loam, 31 to 51 percent slopes (AsE).—This steep soil is on side slopes of prominent hills and on slopes that drop to creek channels and drainageways. It is steeper but is otherwise similar to Auburn very rocky silt loam, 3 to 31 percent slopes. Runoff is very rapid, and the erosion hazard is very severe.

Because of its steep slopes and rock outcrops, this soil is used mostly for range. The slopes are so steep that cattle trail around the slopes rather than graze uniformly. Capability unit VIs–41(18); range site 2.

Auburn extremely rocky silt loam, 3 to 31 percent slopes (AuD).—On this gently sloping to moderately steep soil, rock outcrops occupy as much as 40 percent of the surface in places. Depth to bedrock ranges from 10 to 16 inches. Runoff is medium to very rapid, and the erosion hazard is moderate to very severe.

This soil is used only for range, and yields of forage are low. Capability unit VIIs–7(18); range site 5.

Auburn extremely rocky silt loam, 31 to 71 percent slopes (AuF).—This steep soil is mostly on slopes adjacent to rivers and streams. In places rock outcrops occupy as much as 40 percent of the surface. The soil is generally shallow over bedrock, but pockets between rocks are as deep as 30 inches in places. Slopes are predominately less than 51 percent. Runoff is very rapid, and the erosion hazard is very severe.

This soil is used only for range, and yields of forage are low. Capability unit VIIs–7(18); range site 5.

Auburn silt loam, moderately deep, 3 to 16 percent slopes (ArC).—This soil, one of the best in the Auburn series, is in swales and on moderately steep slopes. It is deeper over bedrock and less sloping and is fairly free of rock outcrops, but it is otherwise similar to Auburn very rocky silt loam, 3 to 31 percent slopes. The surface layer ranges from 7 to 15 inches in thickness. The subsoil is generally light clay loam and is 8 to 15 inches thick. Depth to bedrock ranges from 20 to 30 inches.

This soil is well drained. Permeability of the surface soil is moderate, and that of the subsoil is moderate to moderately slow. The available water holding capacity is moderate, root penetration is moderately deep, and fertility is moderate. Runoff is slow to medium, and the erosion hazard is slight to moderate.

Areas of this soil are small and are generally in isolated places surrounded by very rocky, shallow soils used as range on the large ranches. The soil is used mostly for range, but it is also suited to hay and grain, to irrigated pasture and vineyards, and to perennial grasses. Areas

in range can be made more productive by reseeding them to more desirable grasses and legumes. Capability unit IIIe–8(18); range site 1.

Auburn silt loam, moderately deep, 16 to 31 percent slopes (ArD).—This inextensive, strongly sloping to moderately steep soil is on prominent hills. Its profile is similar to that of the other moderately deep Auburn soils and is comparatively free of rocks. Runoff is medium to rapid, and the erosion hazard is moderate to severe.

Steep slopes make tillage risky and restrict the use of this soil to range or to sprinkler irrigated pasture. Range on this soil is fairly productive if well managed. Capability unit IVe–8(18); range site 1.

Auburn very rocky silt loam, moderately deep, 3 to 31 percent slopes (AtD).—This gently sloping to moderately steep soil is in hilly areas. Except for rock outcrops, which occupy as much as 20 percent of the surface, it is similar to the other moderately deep Auburn soils. Runoff is slow to rapid, and the erosion hazard is slight to severe.

Rock outcrops make annual tillage of this soil impractical, and it is therefore used mostly for range. In some deteriorated areas, a partial seedbed can be prepared and the soil reseeded to more productive grasses and legumes. Capability unit VIs–8(18); range site 1.

Auburn very rocky silt loam, moderately deep, 31 to 51 percent slopes (AtE).—Except for stones and stronger relief, this soil is similar to Auburn silt loam, moderately deep, 3 to 16 percent slopes. In some areas of this steep soil on north-facing slopes, the subsoil is red or reddish brown in color and approaches clay loam in texture. Runoff is very rapid, and the erosion hazard is very severe.

This soil is used mostly for range, and it is fairly productive if it is well managed. Capability unit VIs–81(18); range site 1.

Auburn extremely rocky silt loam, moderately deep, 31 to 71 percent slopes (AvE).—This steep soil is generally adjacent to rivers and streams. In places rock outcrops occupy as much as 40 percent of the surface area. In the soil between the rocks, depth to bedrock ranges between 20 to 30 inches. Runoff is very rapid, and the erosion hazard is very severe. Slopes are dominantly less than 51 percent.

The slope makes it difficult to use this soil for grazing, because livestock trail around the slopes, rather than graze the whole area uniformly. Capability unit VIIs–7 (18); range site 5.

Auburn-Argonaut silt loams, 0 to 16 percent slopes (AwC).—This mapping unit consists of Auburn silt loam, 0 to 16 percent slopes, and of Argonaut silt loam, 0 to 16 percent slopes. The Auburn silt loam is well drained. Argonaut silt loam is moderately well drained and more silty than Argonaut very rocky loam, 3 to 31 percent slopes. These soils are generally in swales that have concave slopes, and they are relatively free of rock outcrops.

Included with these soils in mapping is a small acreage of very shallow, grayish-brown soils formed in material from slate and schist.

Auburn-Argonaut silt loams, 0 to 16 percent slopes, are used mostly for range, but some areas are periodically used for hay and grain. Range on these soils is productive if the soils are well managed. Runoff water from adjacent slopes collects in some areas and causes the soils to be wet. Because of prolonged wetness, yields of range are low in some of the swales. Yields of crops and of range increase if a fertilizer that contains nitrogen and phosphate is applied. Capability unit IIIe–8(18); range site 2.

Auburn-Argonaut very rocky silt loams, 3 to 31 percent slopes (AxD).—This mapping unit consists of Auburn very rocky silt loam, 3 to 31 percent slopes, and of Argonaut very rocky silt loam, 3 to 31 percent slopes. Runoff is medium to rapid, and the erosion hazard is moderate to severe.

Rocks make cultivation of these soils impractical. The areas can be used for range, however, and are productive if well managed. Capability unit VIs–8(18); range site 2.

Cohasset Series

The Cohasset series consists of well-drained, moderately deep to very deep, friable, medium acid soils formed in material from weathered, volcanic conglomerate. These soils are gently sloping to very steep. They are in mountainous areas at elevations of 2,000 to more than 5,000 feet. Conifers, hardwoods, brush, and grass make up the vegetation.

The surface layer is reddish-brown to dark reddish-brown loam. It is granular and very friable and is medium acid. The subsoil is dark-red to yellowish-red clay loam that has blocky structure, is slightly sticky and plastic, and is very strongly acid. In many places the profile contains large numbers of cobblestones and rocks that are dominantly between 5 and 10 inches in diameter. Depth to weathered, tuff-cemented conglomerate ranges from 25 to more than 80 inches.

Cohasset soils are used mostly for timber but are grazed in some places. Small, open, cleared areas are used for pasture. A limited acreage is occupied by small orchards, mainly apple trees, planted for family use.

Cohasset very cobbly loam, 16 to 51 percent slopes (CbE).—This strongly sloping to steep soil, the most extensive of the Cohasset series, is on slightly convex slopes. Rounded cobblestones, ranging from 5 to 10 inches in diameter, make up as much as 35 percent of the soil mass, by volume, in places.

Representative profile under coniferous forest:

1½ inches or less of pine needles, oak leaves, and twigs; decomposing in the lower part.
0 to 8 inches, reddish-brown loam; weak, fine, granular structure; soft when dry, very friable when moist; medium acid to strongly acid.
8 to 19 inches, yellowish-red clay loam; massive; soft when dry, friable when moist; medium acid to strongly acid.
19 to 27 inches, strong-brown heavy clay loam; massive; slightly hard when dry, friable when moist, sticky and plastic when wet; very strongly acid.
27 to 39 inches, reddish-yellow clay loam; massive; slightly hard when dry, friable when moist, slightly sticky and slightly plastic when wet; fewer roots than in horizon above; very strongly acid.
39 to 50 inches +, a mixture of loam and weathered, andesitic tuff.

The surface layer ranges from reddish brown to dark reddish brown in color and from 15 to 30 inches in thickness. The subsoil ranges from dark red to yellowish red and reddish yellow in color, from 30 to 50 inches in thickness, and from light clay loam to heavy clay loam in texture. It is very strongly acid in places. Depth to weathered, brown, cobbly conglomerate ranges from 36 to

60 inches. Cobblestones make up 15 to 50 percent of the soil mass, by volume. In a small acreage the subsoil consists of clay.

This soil is well drained. Permeability of the surface soil is moderate, and that of the subsoil is moderate to moderately slow. The available water holding capacity is high, root penetration is very deep, and fertility is moderate. Runoff is medium to rapid, and the erosion hazard is moderate to very severe.

Steep slopes and cobblestones prohibit tillage of this soil, but some areas are used for summer grazing. This soil is good for timber, and under good management, rapid-growing stands of timber of high quality are produced. Most areas have stands of incense-cedar, sugar pine and other pine, white fir, and a few red firs or Douglas-firs that are used commercially for lumber. Care is needed in logging to maintain productivity of this soil. Capability unit VIs–1(22); woodland suitability group 3.

Cohasset loam, 5 to 16 percent slopes (CaC).—This gently sloping to strongly sloping soil is on ridges. It is not extensive, but it is one of the best soils of the Cohasset series. Generally it contains less than 5 percent of cobblestones, and they are mainly below a depth of 60 inches. In a small acreage where the slope is generally gentle, the subsoil is clay. On foot slopes where the slope is generally strong, the soil is reddish brown, and it formed in material from slate and schist. Runoff is slow to medium, and the erosion hazard is slight to moderate.

Use of this soil for crops is limited, because of the climate and the small isolated areas. The soil is therefore used mostly for timber, but some areas are used for grazing, and a small acreage is used for orchards of apples and walnuts. Orchard crops on this soil respond well if a fertilizer that contains nitrogen and phosphate is applied. Mountain misery or bracken fern commonly invades areas that were cleared or areas where the vegetation was destroyed by fire. Capability unit IIIe–1(22); woodland suitability group 1.

Cohasset loam, 16 to 31 percent slopes (CaD).—This moderately steep soil is on side slopes and ridges. Except for the few cobblestones in its profile, it is similar to Cohasset very cobbly loam, 16 to 51 percent slopes. Runoff is medium to rapid, and the erosion hazard is moderate to severe.

Climate and steep slopes limit cultivation of this soil. It is therefore used mostly for timber. A small acreage is planted to apples, but most of the orchards have been abandoned. Capability unit IVe–1(22); woodland suitability group 3.

Cohasset very cobbly loam, 3 to 16 percent slopes (CbC).—This gently sloping to strongly sloping soil is on slightly convex ridges in areas on the fringe of Aiken soils. Rounded cobblestones 5 to 10 inches in diameter occupy 15 to 50 percent of the profile. Depth to weathered bedrock ranges from 40 to more than 80 inches. Runoff is slow to medium, and the erosion hazard is slight to moderate.

This soil is used mainly for timber and for grazing. If it is well managed, it is fairly productive. Capability unit Vs–7(22); woodland suitability group 1.

Cohasset very cobbly loam, 51 to 71 percent slopes (CbF).—This very steep soil is on side slopes of breaks that lead to rivers and streams. Depth of the soil increases as the slope descends because soil from the upper part of the slope moves down and covers the lower areas. On the foot slopes the soil is 80 inches or more in depth, but near the crest of the ridges the depth may be as little as 36 inches. In some places the subsoil contains little clay and is generally loam in texture. In places soil moving downslope covers other adjacent soils or is mixed with them. Runoff is very rapid, and the erosion hazard is very severe.

Because of strong slopes and cobblestones in the profile, this soil is used only for timber and grazing. Capability unit VIIs–1(22); woodland suitability group 4.

Cohasset very cobbly loam, moderately deep, 3 to 16 percent slopes (CcC).—Most of this soil is on narrow ridges. The surface soil is reddish brown to brown and 8 to 15 inches thick. The subsoil, a dark-red to yellowish-red heavy loam or clay loam, is 10 to 20 inches thick. Cobblestones make up 15 to 50 percent of the profile, by volume. Depth to weathered bedrock ranges from 25 to 40 inches. In places the soil is moderately eroded.

The permeability of the surface soil is moderate, and that of the subsoil is moderately slow. Available water holding capacity is moderate, and root penetration is moderately deep to deep. Runoff is slow to medium. The erosion hazard is slight to severe.

This soil is used mostly for timber and grazing. It is less productive than the deep Cohasset soils, but it produces moderately fast growing trees of good quality. Capability unit VIs–8(22); woodland suitability group 5.

Cohasset very cobbly loam, moderately deep, 16 to 51 percent slopes (CcE).—This steep soil is on side slopes and ridges. It is generally less than 40 inches deep over bedrock, but it is otherwise similar to Cohasset very cobbly loam, 16 to 51 percent slopes. Runoff is rapid to very rapid, and the erosion hazard is severe to very severe.

This soil is used mainly for timber and produces moderately fast growing trees of good quality. Capability unit VIs–81(22); woodland suitability group 7.

Cohasset very cobbly sandy loam, 3 to 16 percent slopes (CoC).—This gently sloping to strongly sloping soil is on ridges and side slopes. It has gentler slopes than Cohasset very cobbly sandy loam, 16 to 51 percent slopes, but is otherwise similar to that soil. Runoff is slow to medium, and the erosion hazard is slight to moderate.

This soil is used for timber. It is highly productive. Trees on it grow fairly fast and are of good quality. Capability unit Vs–7(22); woodland suitability group 1.

Cohasset very cobbly sandy loam, 16 to 51 percent slopes (CoE).—This soil is generally at elevations of more than 3,500 feet. Here the climate is cooler than at lower elevations. Consequently, weathering of the parent material is less complete, and minerals do not break down so readily. Annual rainfall ranges from 45 to 55 inches.

The surface layer is reddish-brown to dark reddish-brown sandy loam; it is gritty but contains few or no grains of quartz. This layer ranges from 15 to 30 inches in thickness. Some clay has accumulated in the subsoil, which ranges from loam to light clay loam. Generally, the subsoil is a layer of dark-red to yellowish-red clay loam 30 to 50 inches thick. Depth of the profile over weathered conglomerate ranges from 40 to 74 inches.

Permeability of the surface soil is moderately rapid, and that of the subsoil is moderate. The available water holding capacity is high, root penetration is very deep, and natural fertility is moderate. Runoff is medium to very rapid, and the erosion hazard is severe to very severe.

A small acreage of this mapping unit consists of dark grayish-brown very cobbly gravelly sandy loam or of grayish-brown soil material formed in material from granodiorite.

Cohasset very cobbly sandy loam, 16 to 51 percent slopes, is predominantly in timber. Douglas-fir and red fir are more abundant than at lower elevations. This soil is highly productive of timber, and trees on this soil grow rapidly. It erodes readily, particularly if logging is done carelessly. Capability unit VIs–1(22); woodland suitability group 3.

Exchequer Series

In the Exchequer series are somewhat excessively drained, very rocky and very shallow soils that are slightly acid (fig. 16). These soils are gently sloping to steep.

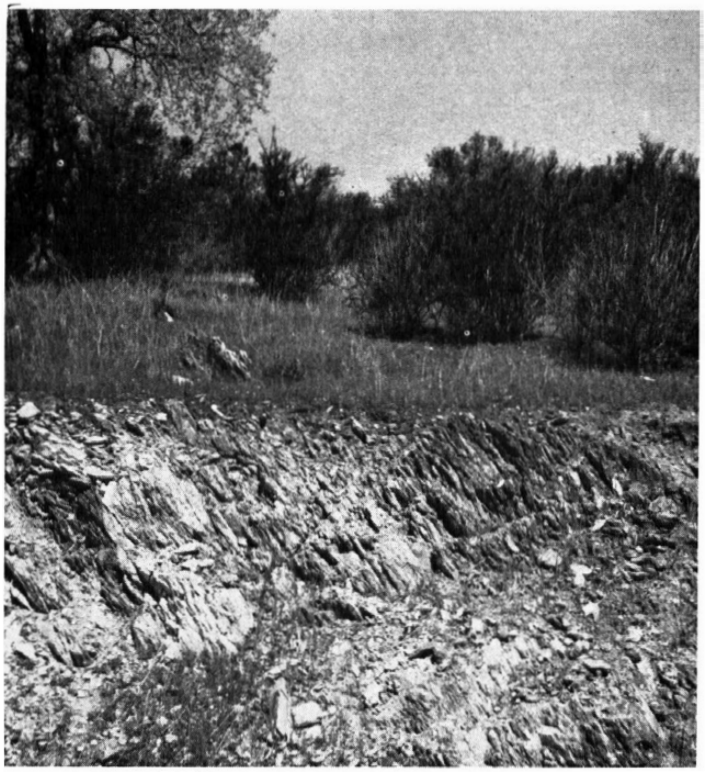

Figure 16.—**Road cut in an Exchequer soil, which is very shallow.**

They formed in metabasic and metasedimentary rock and are at elevations of 500 to 1,000 feet in a belt that extends northward from the Mokelumne River to the El Dorado County line. The vegetation is mostly dense brush, with scattered oaks and digger pines, but includes some sparse stands of grass.

The surface soil is granular, friable, slightly acid, very rocky silt loam. It is dark brown, brown, grayish brown, or reddish brown and rests abruptly on bedrock, generally at a depth of about 6 inches. Some pockets, however, are as deep as 18 inches. In places outcrops of vertically tilted schistose rocks occupy 20 to 50 percent of the surface. Rock fragments are abundant in the profile. Exchequer soils generally adjoin Auburn soils and areas of andesitic rock land.

Some areas of Exchequer soils are used for range, but they have limited value for grazing. The soils also provide browse areas for wildlife and serve as protected watersheds.

Exchequer very rocky silt loam, 3 to 31 percent slopes (EcD).—This gently sloping to strongly sloping soil is on hills and ridges.

Representative profile under brush:

0 to 6 inches, dark-brown very rocky silt loam; weak, fine, granular structure; soft when dry, friable when moist; many pores; slightly acid.
6 inches +, pale-yellow, vertically tilted, amphibolite schist; medium acid.

From 20 to 30 percent of the surface area is rock outcrop. The surface soil ranges from loam to silt loam in texture and is reddish brown in some places. In places as much as 10 percent of this mapping unit consists of moderately deep, strong-brown or reddish-brown rocky silt loam.

This soil is somewhat excessively drained. Permeability is moderate. The available water holding capacity is very low, root penetration is very shallow, and fertility is low. Runoff is medium to very rapid, and the erosion hazard is moderate to very severe.

Although this soil has little value for agriculture, it provides limited grazing and browse for wildlife and serves as a protected watershed. Capability unit VIIs–4(18); range site 9.

Exchequer very rocky silt loam, 31 to 51 percent slopes (EcE).—This soil is on side slopes of prominent hills and on sharp breaks that lead to streams and rivers; one large area is near the Pardee Reservoir. Except for its steepness, this soil is similar to Exchequer very rocky silt loam, 3 to 31 percent slopes.

In places, generally in very steep areas, this mapping unit is mainly rock land. Runoff is very rapid, and the erosion hazard is very severe.

This soil has limited use for grazing. It is used for range, wildlife, and a protected watershed. Capability unit VIIs–4(18); range site 9.

Exchequer and Auburn loams, 3 to 31 percent slopes (EhD).—This mapping unit consists of Exchequer loam, 3 to 31 percent slopes, and of Auburn loam, 3 to 31 percent slopes, in variable proportions. These soils are less silty than Exchequer very rocky silt loam, 3 to 31 percent slopes, and Auburn very rocky silt loam, 3 to 31 percent slopes. They are comparatively free of rock outcrops. The Exchequer loam is somewhat excessively drained, and the Auburn loam is well drained. This undifferentiated unit is on undulating to hilly slopes, knolls, and ridges. Some gently sloping areas on flats near Plymouth are slightly mottled, as the result of seasonal wetness, and have a subsoil of clay or clay loam. In some places, generally near areas of metabasic rock, the soil is almost exclusively Auburn loam.

These soils are used mostly for grazing. Some gently sloping areas are used for dry-farmed hay and grain or for improved pasture. Large areas are relatively unimproved and consist of grass-oak rangeland. Hay and grain crops and forage plants respond if fertilizer that contains nitrogen and phosphate is applied. Range that has deteriorated can be reseeded to more productive grasses and legumes. Dense thickets of brush and oak can be thinned and the areas made more productive. If the soils are well managed, yields of forage are moderate

to good. The Exchequer loam is in capability unit VIs–4(18), and the Auburn loam is in capability unit IVe–4(18); both are in range site 2.

Exchequer and Auburn very rocky loams, 3 to 31 percent slopes (ExD).—This mapping unit consists of Exchequer very rocky loam, 3 to 31 percent slopes, and of Auburn very rocky loam, 3 to 31 percent slopes, in variable proportions. These soils are less silty than Exchequer very rocky silt loam, 3 to 31 percent slopes, and Auburn very rocky silt loam, 3 to 31 percent slopes. Generally, these moderately steep soils are on knolls and ridge crests in slaty areas. The soils in this unit are very shallow to bedrock, and bedded strata are exposed.

These soils are used mostly for grazing. Rock outcrops and nearness of bedrock to the surface restrict cultivation. Management practices for rangeland are similar to those for Exchequer and Auburn loams, 3 to 31 percent slopes. The Exchequer very rocky loam is in capability unit VIIs–4(18) and range site 9; the Auburn very rocky loam is in capability unit VIs–4(18) and range site 2.

Exchequer and Auburn very rocky loams, 31 to 51 percent slopes (ExE).—This mapping unit consists of Exchequer very rocky loam, 31 to 51 percent slopes, and of Auburn very rocky loam, 31 to 51 percent slopes. These soils are less silty than Exchequer very rocky silt loam, 31 to 51 percent slopes. These steep soils are on hills and ridges and on slopes that drop to rivers and creeks.

These soils are used for grazing. Potential production of usable forage is similar to that of the other undifferentiated Exchequer and Auburn soils. On steep slopes livestock graze in trails, and uniform grazing is hard to achieve. Fencing the areas and placing watering and salting facilities in strategic spots to draw livestock from overgrazed areas help promote uniform grazing. The Exchequer very rocky loam is in capability unit VIIs–4(18) and range site 9; the Auburn very rocky loam is in capability unit VIs–41(18) and range site 2.

Fiddletown Series

The Fiddletown series consists of well-drained, deep to moderately deep, gravelly or rocky soils that are moderately sloping to very steep. These soils formed in material weathered from metasedimentary, dark-colored, carbonaceous slate or schist. They are in the central part of the Area, in the upper foothills or mountains at elevations of 1,500 to 3,000 feet. Conifers, hardwoods, brush, and grass make up the vegetation.

The surface soil is dark grayish-brown to dark reddish-brown, friable gravelly loam that grades to fine sandy loam. It is slightly acid to medium acid. The subsoil is dark brown and is generally about the same texture as the surface soil, but in places it is light clay loam. The subsoil is slightly acid to medium acid. Fiddletown soils are granular. They are soft when dry and friable to very friable when moist. The organic matter content is moderate to high.

Rock outcrops occupy from 15 to 25 percent of the surface of this soil in places. In many places slaty rock fragments, dominantly between 1 and 6 inches in length, comprise a large percentage of the profile. These rock fragments become more numerous with increasing depth. Depth to bedrock varies considerably within short distances because of variation in the degree of incline and in the mineral composition and hardness of the material. The depth ranges from 20 to 60 inches.

Fiddletown soils are used chiefly for timber, but they have some value for grazing. In some places burned or cleared areas are used for grazing or are seeded occasionally to hay or grain. The chief conifers used for timber are second-growth ponderosa pine, incense-cedar, sugar pine, and a few white firs.

Fiddletown very rocky loam, 16 to 51 percent slopes (FoE).—This moderately steep to steep soil, the most extensive of the Fiddletown series, is on hills and ridges. Some areas are moderately eroded.

Representative profile under conifers and browse:

2 inches or less of loose litter that consists of pine needles, oak leaves, and twigs and is partly decomposed in the lower part.
0 to 8 inches, dark grayish-brown gravelly loam; moderate, very fine, granular structure; soft when dry, friable when moist, slightly sticky and slightly plastic when wet; slightly acid.
8 to 22 inches, dark-brown gravelly loam that is 25 percent gravel, cobblestones, and larger stones; moderately fine, granular structure; soft when dry, friable when moist; slightly acid.
22 to 45 inches, similar to the layer above, but as much as 80 percent, by volume, consists of gravel, cobblestones, or bedrock.
45 inches +, gray, fractured schist.

The surface layer ranges from dark reddish brown to dark grayish brown. In some places the subsoil is light clay loam, but in most places it is more dark brown and less gray than the surface soil. Rock outcrops occupy 15 to 25 percent of the surface. At a depth below 2 feet, rock fragments comprise from 40 to 80 percent of the soil mass, by volume. Depth to weathered bedrock ranges from 20 to 58 inches but is dominantly about 30 inches.

This soil is well drained. Permeability is moderate to moderately rapid. The available water holding capacity is moderate to low, depending on the abundance of loose rock in the profile. Root penetration is moderately deep, and fertility is moderate. Runoff is medium to very rapid. The erosion hazard is moderate to very severe.

In small areas the soil is very rocky loam that is yellowish red and has a subsoil of clay loam. In other areas the soil is very rocky loam that is shallow to bedrock and brown or yellowish brown, or is very rocky loam that is very shallow to bedrock.

Fiddletown very rocky loam, 16 to 51 percent slopes, is used mostly for timber and for grazing. About 10 percent of the acreage has been cleared and has a fair stand of annual grasses and a few perennials. Trees on this soil grow fairly rapidly and are of good quality. Most areas have been logged in the past, and few large trees remain. Capability unit VIs–1(22); woodland suitability group 7.

Fiddletown gravelly loam, deep, 3 to 10 percent slopes (FgB).—This gently sloping to moderately sloping soil is one of the best soils in the Fiddletown series. It is inextensive and is in flats and valleys. The soil is fairly free of rock outcrops, but the surface soil is gravelly and the rock content generally increases at a depth below 40 inches. Depth to bedrock ranges from about 50 inches to more than 60 inches. The permeability, available water holding capacity, and fertility are moderate. Root penetration is deep. Runoff is slow to medium, and the erosion hazard is slight to moderate.

This soil is one of the better soils in the Area for timber, but most of it has been cleared and is used for grazing. Some areas are invaded by mountain misery or bracken fern. In some places the soil is dry-farmed to hay or grain, and in years when rainfall is favorably spaced, yields are good. Crops and range plants on this soil respond well if fertilizer that contains nitrogen and phosphate is applied. Capability unit IIe–1(22); woodland suitability group 1.

Fiddletown very rocky loam, deep, 16 to 51 percent slopes (FtE).—This moderately steep to steep soil is on ridges and slopes that drop to creeks and stream channels. Depth to weathered rock ranges from 50 to more than 60 inches. In places rock outcrops occupy from 15 to 25 percent of the surface. Rock fragments make up from 25 to 40 percent of the soil mass in places, mainly at a depth below 40 inches.

The permeability and available water holding capacity of this soil are moderate. Root penetration is deep. Runoff is medium to very rapid, and the erosion hazard is moderate to very severe.

Because of rocks and steep slopes, this soil is not suited to crops. It is used mostly for timber and grazing. If this soil is well managed, trees on it grow rapidly and are of high quality. Capability unit VIs–1(22); woodland suitability group 3.

Fiddletown gravelly loam, 9 to 16 percent slopes (FdC).—This strongly sloping soil is on hills and ridges. Depth to bedrock is moderate and ranges from 28 to 40 inches. The areas are fairly free of rock outcrops, but numerous slaty fragments the size of gravel are in the profile. Runoff is medium, and the erosion hazard is moderate.

Most of this soil is used for timber. Some areas have been cleared and are used mostly for grazing cattle, or are planted periodically to grain or hay for use on the farm. Growth of timber is moderate on this soil, and the timber is of good quality. Second- or third-growth conifers are on all areas, and there are few or no first-growth trees. Brushy areas can be cleared to allow natural regeneration of trees, or trees can be planted. Yields of grass are fair if the areas are properly grazed. Capability unit IIIe–8(22); woodland suitability group 5.

Fiddletown gravelly loam, 16 to 31 percent slopes (FdD).—This moderately steep soil is on hills and ridges. It has few rock outcrops. Runoff is rapid, and the erosion hazard is moderate to severe.

This soil is used mostly for timber, and if it is well managed, trees on it grow at a moderate rate and are of good quality. The soil is likely to erode if it is cultivated or carelessly logged, or if it is overgrazed. Cleared areas are mostly grazed, but occasionally they are planted to hay and grain. Yields of forage or timber increase if brushy areas are carefully thinned. Capability unit IVe–8(22); woodland suitability group 6.

Fiddletown very rocky loam, 51 to 71 percent slopes (FoF).—This soil is on sharp breaks to streams and on very steep slopes in mountainous areas. In places rock outcrops occupy from 15 to 25 percent of the surface, and rock fragments are numerous in the profile. Except for steeper slopes, this soil is similar to Fiddletown very rocky loam, 16 to 51 percent slopes. Runoff is very rapid, and the erosion hazard is very severe.

This soil is used only for timber and for light grazing by cattle. It is highly susceptible to erosion if it is logged carelessly or if the forest cover is removed by fire. Therefore, special practices are necessary when logging is done. If this soil is well managed, trees on it grow at a moderate rate and are of good quality. Capability unit VIIs–81(22); woodland suitability group 8.

Henneke Series

In the Henneke series are well drained, very rocky, very shallow, dark reddish-brown soils formed in material from serpentine (fig. 17). These soils are gently sloping to steep. They are in foothills on ridges and side slopes at

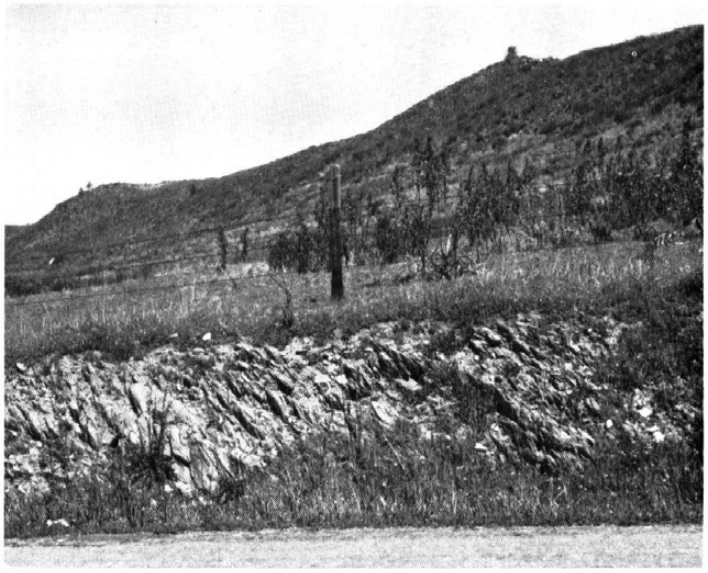

Figure 17.—**A Henneke soil exposed in a road cut in the foreground; on the ridge in the background is Serpentine rock land.**

elevations of 300 to 1,000 feet. Henneke soils are in the western part of the Area in a belt that extends northward from the Mokelumne River to the El Dorado County line. The vegetation is mostly a dense cover of brush, but it includes scattered digger pines and oaks and a sparse understory of grass.

The surface soil, a dark reddish-brown loam or silt loam, is friable and is slightly acid to neutral. The subsoil is reddish-brown clay loam or silty clay loam. It is slightly acid to neutral. Depth to bedrock ranges from 2 to 12 inches. Natural fertility is low. These soils have a low calcium-magnesium ratio and are probably deficient in other nutrients. In some places the areas mapped consist mainly of Serpentine rock land.

Henneke soils have limited value for grazing and provide small amounts of forage for sheep, goats, and cattle. Most areas are used as watershed or to provide browse for wildlife.

Henneke very rocky loam, 3 to 51 percent slopes (HaD).—This is the only soil of the Henneke series mapped in this Area. It is gently sloping to steep and is on ridges and side slopes.

Representative profile under brush:

0 to 4 inches, dark reddish-brown gravelly loam; moderate, coarse, granular structure; soft when dry, friable when moist, slightly plastic when wet; neutral.

4 to 9 inches, reddish-brown gravelly clay loam; weak, very fine, subangular blocky structure; soft when dry, friable when moist, plastic when wet; neutral.
9 inches +, grayish-green, massive and hard serpentine.

The surface soil is dark brown to dark reddish brown and ranges from loam to silt loam. The subsoil, a clay loam or silty clay loam, is absent in some places where the soil is very shallow over bedrock. Depth to bedrock ranges from 2 to 12 inches. Rock outcrops occupy more than 20 percent of the surface in places. Rock fragments within the profile vary in size from gravel to large stones, and in some places they make up 50 percent of the soil mass.

This soil is well drained. Permeability is moderate. The available water holding capacity is very low, root penetration is very shallow, and fertility is very low. Runoff is medium to very rapid, and the erosion hazard is moderate to very severe.

Included with this soil in mapping is a small acreage of clay-textured alluvium in swales or nearly level areas. This alluvial material was washed from Henneke soils and from Serpentine rock land. The areas are shown on the map by a clay-spot symbol. The soil material is very dark gray to black clay; it ranges from 30 to more than 50 inches in depth and commonly contains gravelly fragments of serpentine and quartz. This included soil is generally poorly drained, has cracks in the surface, and is low in fertility. On some areas there are pure stands of goatgrass. Also included are areas of Serpentine rock land. These areas are generally very steep and make up as much as 15 percent of this mapping unit.

Henneke very rocky loam, 3 to 51 percent slopes, has limited value for grazing. It is used for range, as browse areas for wildlife, or as protected watershed. Capability unit VIIs–9(18); range site 7.

Holland Series

The Holland series consists of deep to moderately deep, well-drained soils formed in deeply weathered granitic rock. These soils are moderately sloping to steep. They are in the eastern part of the Area on mountainous ridges and side slopes at elevation of 1,600 to 5,000 feet. Conifers, oaks, brush, and grass make up the vegetation.

The surface layer, a light brownish-gray to grayish-brown coarse sandy loam, is porous, friable, and slightly acid. It is massive to granular and slightly hard when dry. The subsoil is light yellowish-brown to very pale brown, heavy, coarse sandy clay loam or clay loam that is friable to firm and is medium acid. It is generally massive and fairly hard when dry. Depth to deeply weathered granitic rock ranges from 25 to more than 60 inches.

The amount of rock in the profile varies. In some places the soils are nearly free of rock and only a few rock "floaters" are in the profile. In places from 5 to 25 percent of the surface consists of rock outcrops and stone fragments make up 20 percent of the soil profile.

Holland soils are used mainly for timber and some grazing. Small acreages at the lower elevations are planted to orchards of walnuts or apples or to vineyards. These crops are grown without irrigation. Yields are generally low, depending upon rainfall and whether or not frost is late. Where water is available, small areas are planted to family gardens.

733-020—65——7

Holland coarse sandy loam, deep, 9 to 16 percent slopes (HdD).—This strongly sloping soil is on hills in the north-central part of the Area.

Representative profile under forest and grass:

0 to 4 inches, light brownish-gray coarse sandy loam; massive, but breaks to very fine, granular structure; slightly hard when dry, friable when moist; slightly acid.
4 to 10 inches, similar to layer above, but brown in color.
10 to 22 inches, light yellowish-brown heavy coarse sandy loam; massive; hard when dry, friable when moist, slightly plastic when wet; medium acid.
22 to 38 inches, light yellowish-brown coarse sandy clay loam; massive; very hard when dry, firm when moist, plastic and slightly sticky when wet; medium acid.
38 to 49 inches, very pale brown coarse sandy loam; massive; hard when dry, friable when moist, plastic and slightly sticky when wet; medium acid.
49 to 58 inches, in place material in this layer has the appearance of weathered granite, as biotite, quartz, and feldspar minerals are still evident, but it crumbles to pale-yellow light coarse sandy loam; very hard when dry, friable when moist, slightly sticky and slightly plastic when wet; medium acid to strongly acid.
58 to 70 inches +, white, decomposing granite that crumbles to gravelly coarse sandy loam; strongly acid.

The color of this soil generally is whiter or paler with increasing depth. Depth to weathered bedrock ranges from 40 to more than 60 inches. The surface layer is loamy fine sand in some places. Its color ranges from light brownish gray to grayish brown. The subsoil ranges from coarse sandy clay loam to clay loam in texture, and from light yellowish brown to very pale brown in color. The thickness of the surface layer is 6 to 12 inches, and that of the subsoil, 30 to 50 inches. In places the bedrock is weathered to a depth between 15 and 20 feet.

This soil is very porous and is well drained. Permeability is moderately rapid in the surface soil and moderate in the subsoil. The available water holding capacity is high, root penetration is very deep, and fertility is moderate. Runoff is slow to medium, and the hazard of erosion is moderate to severe.

Included with this soil in mapping are some areas of Musick sandy loam and of Shaver very rocky coarse sandy loam.

Holland coarse sandy loam, deep, 9 to 16 percent slopes, is highly susceptible to erosion if it is cleared and cultivated or if the cover is removed by fire or other means. It is used for timber and produces trees of good quality that grow rapidly. The tree roots evidently penetrate the weathered bedrock and obtain additional moisture from it. Grasses and browse, suitable for grazing cattle and sheep, grow on some open areas and cleared spots. A small acreage is used for home gardens and deciduous orchards. Capability unit IVe–1(22); woodland suitability group 2.

Holland coarse sandy loam, deep, 5 to 9 percent slopes (HdC).—This soil is on foot slopes and in valleys. It is inextensive, but it is one of the best soils in the Holland series. Except for having gentler slopes, it is similar to Holland coarse sandy loam, deep, 9 to 16 percent slopes. Runoff is slow, and the erosion hazard is moderate.

Most of this soil is cropped. A small acreage below Pine Grove, where irrigation water is available from a ditch supplying domestic water to Jackson, is used to raise vegetables and for pasture. Near Shenandoah a small acreage is used for grazing cattle and sheep. The remaining acreage is used for timber.

If this soil is cleared or cultivated, it is subject to erosion. Cultivated crops should be planted across the slope, and the application of irrigation water should be well controlled. Crops on this soil respond if fertilizer that contains nitrogen and phosphate is applied, and if sulfur is added occasionally. Capability unit IIIe–1(22); woodland suitability group 2.

Holland very rocky coarse sandy loam, deep, 16 to 51 percent slopes (HkE).—Areas of this moderately steep to steep soil are on ridges and canyon slopes adjacent to rivers and streams. In places rock outcrops occupy 5 to 25 percent of the surface. The subsoil in some places has little clay accumulation and is loam in texture; its color is reddish brown in some places. Depth to bedrock ranges from 40 to more than 60 inches in most places. Runoff is rapid to very rapid, and the erosion hazard is very severe.

Steep slopes and rocks make this soil poorly suited to crops, and therefore, it is used mostly for timber. If this soil is well managed, trees grow rapidly and are of high quality. If the trees are removed by fire or through careless logging, the soil is highly susceptible to erosion. Capability unit VIs–1(22); woodland suitability group 4.

Holland coarse sandy loam, 5 to 9 percent slopes (HcC).—This moderately sloping soil is on hills. It is fairly free of rock outcrops. Depth to bedrock ranges from 25 to 40 inches. The surface soil is grayish brown to brown and 3 to 8 inches thick. The subsoil is yellowish brown to reddish brown and generally is sandy clay loam. It ranges from 15 to 25 inches in thickness.

The available water holding capacity is moderate, and root penetration is deep to moderately deep. Runoff is slow, and the erosion hazard is moderate.

Although this soil is used mostly for timber, some cleared areas are used for grazing cattle, sheep, and goats. This soil is suitable for occasional hay and grain crops or for improved pasture if it is well managed. Trees on it are of good quality and grow at a moderate rate. Capability unit IIIe–8(22); woodland suitability group 6.

Holland coarse sandy loam, 9 to 16 percent slopes (HcD).—Generally, this soil is less than 40 inches to bedrock, but it is otherwise similar to Holland coarse sandy loam, deep, 9 to 16 percent slopes. Runoff is medium, and the erosion hazard is moderate to severe.

This soil is used mostly for timber, but some areas are used for hay or grain crops or are planted to vineyards. Crops on this soil should be planted at right angles to the slope. Stubble mulch, crop residues, or other protective covering should be left on the areas during rainy periods to help control erosion. Capability unit IVe–8(22); woodland suitability group 6.

Holland coarse sandy loam, 16 to 36 percent slopes (HcE).—This moderately steep soil is on side slopes and ridges. It is generally less than 40 inches deep over bedrock. Runoff is rapid, and the erosion hazard is very severe.

This soil is too steep for cultivation, and it is used mostly for timber. Open areas or areas that have been cleared are used for grazing cattle and sheep. Trees of good quality grow at a moderate rate on this soil. Care in logging is necessary to help prevent erosion. Also, the areas should not be overgrazed. Capability unit VIs–81(22); woodland suitability group 8.

Holland very rocky coarse sandy loam, 9 to 16 percent slopes (HfD).—This strongly sloping soil is on side hills and ridges. From 5 to 25 percent of the surface is covered by rock outcrops. The available water holding capacity is moderate, and root penetration is deep to moderately deep. Runoff is medium. The erosion hazard is moderate to severe, especially if the vegetation is removed by fire.

Although this soil is used mostly for timber, large areas have been cleared and are used for grazing. In most places rock outcrops and the rolling terrain restrict cultivation. Trees of good quality grow at a moderate rate. Capability unit VIs–8(22); woodland suitability group 7.

Holland very rocky coarse sandy loam, 16 to 51 percent slopes (HfE).—This moderately steep to steep soil is on side slopes that drop down to large rivers and streams. The most extensive areas are northeast of the Shenandoah Valley.

The surface soil is grayish brown to brown and about 3 to 8 inches thick. The subsoil is mostly yellowish brown, but it is reddish brown in some places. Generally, its texture is sandy clay loam, but in places it is clay loam or clay. The thickness of the subsoil ranges from 15 to 25 inches. Depth to bedrock is 25 to 40 inches. Rock outcrops occupy from 5 to 25 percent of the surface. Runoff is rapid to very rapid, and the erosion hazard is very severe.

In some places the soil is moderately deep and reddish brown and has a subsoil of red clay loam or clay. In other places the soil is grayish brown and the subsoil contains little clay.

Holland very rocky coarse sandy loam, 16 to 51 percent slopes, is used chiefly for timber, but also for grazing cattle and sheep. Steep slopes and rock outcrops make this soil difficult to cultivate. The soil is very susceptible to erosion if logging is carelessly done or if the forest cover is destroyed by fire. Capability unit VIs–81(22); woodland suitability group 8.

Holland very rocky coarse sandy loam, 51 to 71 percent slopes (HfF).—This very steep soil is on slopes of canyons. Runoff is very rapid and the erosion hazard is very severe.

This soil is used solely for timber and some summer grazing. Trees of good quality grow at a moderate rate on this soil, but the strong slopes make logging difficult. The carrying capacity of the soil for grazing by cattle or sheep is very low. Livestock graze some kinds of browse and small grassy areas where water is available. Consequently, grazing is spotty. Capability unit VIIs–81(22); woodland suitability group 8.

Honcut Series

The soils in the Honcut series are mostly well drained, but in places they are moderately well drained. These soils are very deep and fertile and formed in recent alluvium. The alluvium consists chiefly of material from basic rock but also of material from metasedimentary rock, sandstone, and clay and of debris from mining operations. Honcut soils are on flood plains, river terraces, and valley bottoms, mainly in the Jackson and Ione Valleys in the southwestern part of the Area. The vegetation on areas that are not in crops is mostly grass and scattered oak. On areas adjacent to streams, cottonwood, willow, poplar, and alder trees are common.

These soils are generally stratified and fairly variable in texture. In most places the surface soil is dark-brown to dark reddish-brown, very fine sandy loam or loam that

is friable and slightly acid to neutral; but in some places it is very dark gray silt loam or clay loam. The subsoil is stratified and similar to the surface soil, or it consists of buried soils. These buried soils are brown to dark-brown very fine sandy loam, loam, or silt loam and are neutral to mildly alkaline. Lenses of sand and gravel, or both, that range from 2 to 10 inches in thickness occur in some places. In some places the soil is underlain by fine material from ore-crushing operations. In general, Honcut soils are granular, friable, and fertile.

Honcut soils are among the best soils in the Area, and they are cropped intensively. Alfalfa, milo, corn, beans for drying, tomatoes, and similar crops are commonly irrigated. Also irrigated are sudangrass pastures and other pastures. Where irrigation water is not available, wheat and barley are grown for hay and grain. Some of the undeveloped areas are used for range.

Honcut very fine sandy loam (Ho).—This nearly level soil, the most extensive soil of the Honcut series, is in valley bottoms or in stringers along Jackson, Sutter, or Dry Creek.

Representative profile under alfalfa:

0 to 11 inches, brown to dark-brown very fine sandy loam; massive; slightly hard when dry, friable when moist, slightly plastic when wet; porous; slightly acid.
11 to 27 inches, yellowish-brown very fine sandy loam; massive; slightly hard when dry, friable when moist; porous; stratified with lenses of silt; slightly acid to neutral.
27 to 36 inches, brown to dark-brown silt loam; massive; slightly hard when dry, friable when moist, slightly sticky and slightly plastic when wet; neutral.
36 to 45 inches, dark grayish-brown silt loam; massive; hard when dry, friable when moist, slightly sticky and slightly plastic when wet; mildly alkaline.
45 to 60 inches +, similar to layer above but has thin clay films in pores.

The surface soil is characteristically brown, but in places it is nearly dark brown or is reddish brown. Its texture ranges from fine sandy loam to loam. In areas adjacent to stream channels, however, the surface soil is gravelly in places. The subsoil is reddish brown in places and is variable in texture. It is commonly stratified with lenses of silt, sand, and gravel. Generally, the substratum is old alluvium that varies in texture from silt loam to clay loam and clay. In some places the substratum is fine material from mining operations, or consists of unrelated rock. In areas where the substratum has slow to very slow permeability, the horizons above have strong-brown mottlings in places. Depth to the substratum is generally more than 60 inches. Generally, layers of sandy overwash 3 to 14 inches thick are on areas of this soil that are subject to flooding. This soil is mildly alkaline to slightly acid, and the acidity generally decreases with increasing depth.

This soil is mostly well drained. Permeability of the surface soil is moderate, and that of the subsoil moderate to moderately slow. The available water holding capacity is very high, root penetration is very deep, and fertility is very high. Runoff is slow, and the erosion hazard is slight.

Mapped with this soil are some areas of Perkins loam. This included soil is reddish brown and has a subsoil of reddish-brown to red gravelly clay loam. Also, small areas of other soils are included; these included soils adjoin higher terraces.

Where irrigation water is available, Honcut very fine sandy loam is used for alfalfa, for beans for drying, for sweet corn, and for pasture. If irrigation water is not available, the soil is used for milo, wheat, and barley, or for pasture. This soil is easy to till and is well suited to the crops grown. Yields are very good if the soil is well managed. Crops on this soil respond if fertilizer that contains nitrogen and phosphate is applied. Alfalfa generally requires phosphate fertilizer. Capability unit I-1(18); range site 1.

Honcut very fine sandy loam, moderately well drained (Hs).—This soil is in depressional areas in flood plains or behind natural levees, and the areas are generally wet. The surface soil generally is brown or dark brown, but in places it is dark gray. Its texture is fairly sandy in places because of recent deposition by creeks. The subsoil is variable in texture and color, but it generally is moderately fine textured material carried in from mining operations. Commonly, these soils are stratified with lenses of gravel and sand.

This soil is moderately well drained. Permeability of the subsoil is moderate to slow.

Unless this soil is artificially drained, it is too wet for deep-rooted crops. The soil is generally used for irrigated pasture and for field corn and sweet corn. Alfalfa is grown to a limited extent, and some areas are used for range. The moisture-holding capacity of the fine-textured subsoil is of advantage in raising shallow-rooted crops that are dry-farmed. Capability unit IIw-2(18); range site 1.

Honcut very fine sandy loam, channeled (Hv).—This soil consists mainly of material recently deposited by streams meandering from the main channels. The streams flood during the winter rainy period in 2 out of 10 years and damage crops. In some places the soil is deeply gullied and has a mantle of sandy overwash 3 to 14 inches thick. The texture of this soil ranges from gravelly sandy loam to loam and has varying degrees of stratification. Generally, the subsoil is finer textured than the surface soil, mainly because of stratification.

This soil is well drained. Permeability of the surface soil is moderate to moderately rapid, and that of the subsoil is moderate to slow. Fertility is moderate to high. Runoff is slow. The soil is subject to deposition and scouring by floodwater.

If this soil is protected by levees, it is generally used for the crops that are grown on other Honcut soils. Areas that are not protected are used for range. It is difficult to get some plants established without irrigation, because the sandy and gravelly surface soil is droughty. This soil is slightly less productive than Honcut very fine sandy loam and generally requires large amounts of fertilizer. Capability unit IVw-2(18); range site 1.

Honcut silt loam (Hn).—This nearly level soil is on broad plains, mainly in Ione and Jackson Valleys and in stringers along Dry Creek. The surface soil is dark-brown to dark grayish-brown silt loam or light clay loam. Below is slightly finer textured, dark-brown to reddish-brown subsoil. The subsoil is silt loam or clay loam, and it is mottled in a few places at a depth below 36 inches. During most of the year the water table is at a depth below 5 feet. In some places the surface soil is gravelly.

This soil is mostly well drained, but in places it is moderately well drained. Permeability of the surface soil is moderate, and that of the subsoil is moderate to slow.

If irrigation water is available, this soil is fairly productive and suited to most crops. If irrigation water is not available, dry-farmed hay and grain crops, pasture, and milo are grown. Capability unit I–1(18); range site 1.

Honcut clay loam, over clay (Hm).—This soil is in depressional areas of flood plains in valleys and behind natural levees that are lower than the terraces along stream channels. The surface soil is dark grayish-brown to very dark brown clay loam and is commonly underlain by fine-textured clay. The lower part of the profile is commonly mottled or gleyed. In places along stream channels and behind levees the soil is gravelly. In a few places the soil has been placer mined and releveled, and as a result, the layers of the profile are intermixed.

This soil is moderately well drained. Free water stands on the surface after heavy rains. Permeability of the surface soil is moderately slow, and that of the subsoil is slow. The available water holding capacity is high. Root penetration is moderately deep.

Field crops, row crops, and a few truck crops are grown on this soil. The soil is more difficult to till than the other Honcut soils, because of its clay loam surface soil and because of wetness. Alfalfa and other deep-rooted crops generally cannot be grown unless the areas are artificially drained. Planting of row crops and field crops is sometimes delayed because of wetness. Capability unit IIIw–3(18); range site 1.

Inks Series, Deep Variant

In this deep variant from the Inks series are well-drained, moderately deep, friable soils formed in material from volcanic sandstone and conglomerate. These soils are gently sloping to moderately steep. They are mostly in the southwestern part of the Area on foothills at elevations from 200 to 500 feet. The vegetation is mostly grass-oak, but it includes a few digger pines.

The surface soil is brown to dark-brown loam. It is granular, friable, and slightly acid. The subsoil, a brown to dark-brown light clay loam, is blocky in structure and slightly acid to medium acid. Depth to bedrock ranges from 20 to 36 inches. In some places material similar to that of the Perkins and Red Bluff soils caps areas of these soils. In these places the surface layer is cobbly or gravelly.

These soils are used mostly for range, and the range has good carrying capacity. The soils are highly productive. They are suited to cultivation, but they generally occupy small isolated areas surrounded by soils that are suited only to grazing.

Inks loam, deep variant, 3 to 16 percent slopes (IdC).—This gently sloping to strongly sloping soil is on hills and dissected terraces.

Representative profile under grass-oak:

0 to 7 inches, brown loam, massive; slightly hard when dry, friable when moist, slightly sticky when wet; slightly acid.
7 to 11 inches, brown to dark-brown heavy loam; moderate, medium, subangular blocky structure; hard when dry, friable when moist, slightly sticky and slightly plastic when wet; medium acid.
11 to 31 inches, brown to dark-brown clay loam; moderate, medium, subangular blocky structure; hard when dry, friable when moist, sticky and plastic when wet; medium acid.
31 inches +, olive-brown andesitic sandstone that is hard and massive and crushes to coarse loamy sand.

In most places the surface soil is loam, but in some places it is sandy loam. Generally, the surface soil is brown to dark brown, but in some places it is grayish brown. Texture of the subsoil ranges from heavy loam to clay loam. In some places the soil is slightly acid. Cobblestones or pebbles are on the surface in some places. Depth to bedrock ranges from 20 to 36 inches.

This soil is well drained. Permeability of the surface soil is moderate, and that of the subsoil is moderate to moderately slow. The available water holding capacity is moderate, root penetration is moderately deep, and natural fertility is moderate. Runoff is slow to medium, and the erosion hazard is slight to moderate.

This soil is used mostly for range. It is suited to cultivated crops, but it occupies small, isolated areas that are generally inaccessible. The carrying capacity for range is moderately high. Yields increase if fertilizer that contains nitrogen and phosphate is applied. Capability unit IIIe–8(18); range site 1.

Inks Series

The Inks series consists of cobbly, very shallow soils, formed in material from andesitic sandstone and conglomerate. These soils are in the western part of the Area on undulating to gently rolling flats and knolls and steep hills at elevations of 300 to 500 feet. The vegetation is mostly grass-oak, but it includes a few digger pines and some brush.

The Inks soils have a brown, cobbly, slightly acid surface soil over a dark-brown, slightly acid, cobbly clay loam subsoil. Below is hard and cemented andesitic sandstone or conglomerate.

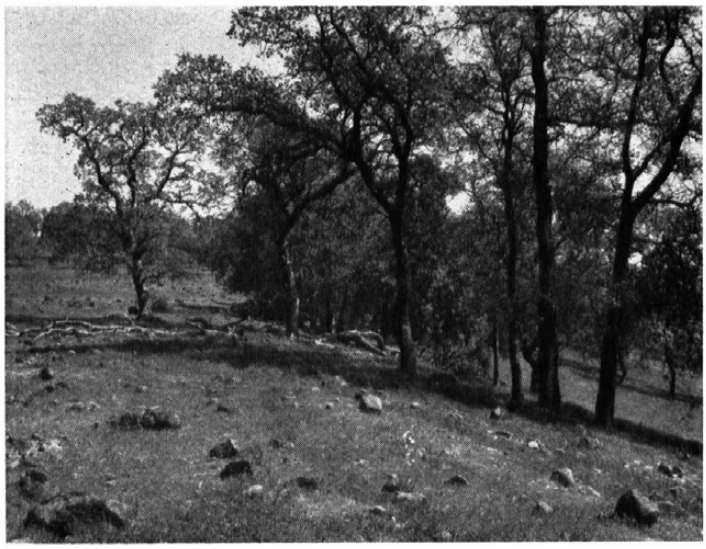

Figure 18. —Typical view of Inks loam and Rock land.

Inks loam and Rock land, 3 to 45 percent slopes (IrE).—This mapping unit consists of Inks loam, 3 to 45 percent slopes, and of Rock land. It is gently sloping to steep and is on hills and dissected terraces. A typical view of Inks loam and Rock land is shown in figure 18.

Representative profile of an Inks loam that is shallow over bedrock, as observed under a cover of range vegetation and brush:

0 to 10 inches, brown very cobbly loam; massive; slightly hard when dry, friable when moist; neutral to slightly acid.
10 to 15 inches, dark-brown very cobbly clay loam; massive; hard when dry, friable when moist, slightly sticky and plastic when wet; slightly acid.
15 inches +, light brownish-gray andesitic sand and conglomerate.

Depth to bedrock ranges from 10 to 20 inches, but it is 36 inches in some places. The moderately deep areas have a subsoil of clay loam. In these areas the surface soil ranges from 8 to 12 inches in thickness.

The areas of Rock land are barren of vegetation and consist largely of outcroppings of andesitic sandstone partly covered by cobblestones and gravel. In some places there is a thin mantle of brown soil material that is generally less than 10 inches deep.

The rest of this unit consists of shallow, brown to reddish-brown very cobbly or gravelly sandy loams. These soils formed in old gravelly alluvium washed from the Sierra Mountains. The alluvium consists of fragments of quartzitic rock and other kinds of rock and contains a few andesitic cobblestones.

The characteristics of the soils in this undifferentiated unit are variable. In general, these soils are well drained to somewhat excessively drained. Permeability is generally moderate. The available water holding capacity is low to very low, root penetration is shallow to very shallow, and natural fertility is low to moderate. Runoff is medium to very rapid. The erosion hazard is moderate to very severe.

This undifferentiated unit is used for range. The areas are generally too rocky and shallow for other uses. Where the soils are moderately deep or are shallow, yields of forage are fair, but on the very shallow soils and on areas of Rock land, yields are very low. Inks loam is in capability unit VIIs–4(18); range site 8. Rock land is in capability unit VIIIs–8(18).

Iron Mountain Series

In the Iron Mountain series are excessively drained, very stony soils that are shallow over bedrock. These soils are medium acid to strongly acid. They formed in material from volcanic conglomerate. Iron Mountain soils are on moderately sloping tabular ridges and moderately steep side slopes at elevations of 500 to more than 5,000 feet. They occupy a belt that extends eastward from Ione in the western part of the Area to the eastern boundary.

At lower elevations the vegetation is mostly grass-oak, but it includes a few digger pines. At intermediate elevations, the vegetation is mainly oak and brush and a few scattered conifers. Conifers, brush, a few hardwoods, and some grass make up the vegetation in most places at higher elevations.

Where underlain by andesitic conglomerate, the surface soil ranges from dark grayish brown to dark brown and very dark brown, but where underlain by rhyolitic tuff, it is almost grayish brown. It is very friable stony loam and is slightly acid to medium acid. Depth to weathered conglomerate ranges from 6 to 24 inches, but in most places it is 10 to 15 inches. Pebbles, cobblestones, and other stones make up 40 to 50 percent of the soil mass, and outcrops of cemented conglomerate are on the surface.

Iron Mountain soils are not extensive. They are used for grazing, and to provide browse for wildlife, and they serve as protected watershed.

Iron Mountain very stony loam, 9 to 51 percent slopes (IsE).—This soil is on very stony, tabular ridges and steep side slopes.

Representative profile under a cover of grass and oak:

0 to 20 inches, dark grayish-brown, very stony loam; weak, medium, subangular blocky structure that breaks to weak, medium, granular; soft when dry, friable when moist; most roots are in the upper 4 inches; medium acid to strongly acid.
20 inches +, very pale brown, very hard, andesitic tuff, with flecks of white and light red; tuff cements cobblestones and other stones; material is partly weathered in the upper part.

The surface soil ranges from dark grayish brown to very dark brown. Depth to weathered bedrock ranges from 6 to 20 inches, but it is dominantly between 10 and 15 inches. Gravel, cobblestones, and other stones make up much of the profile.

This soil is well drained. Permeability is moderate. The available water holding capacity is low, root penetration is shallow, and natural fertility is moderate. Runoff is medium to very rapid, and the erosion hazard is moderate to very severe.

In places about 15 percent of this mapping unit consists of Rock land. In other places 10 percent of the unit consists of soil that is moderately deep over bedrock.

Iron Mountain very stony loam, 9 to 51 percent slopes, is used mostly for range at lower and middle elevations. At higher elevations there are slow-growing conifers in places, and these are cut for poles and firewood. Yields of forage and trees are generally low. Capability units VIIs–4(18) and VIIs–4(22); range site 8; woodland suitability group 9.

Iron Mountain very stony loam, rhyolite substratum, 9 to 51 percent slopes (IvE).—This soil is on tabular ridges and steep side slopes.

Representative profile under grass-oak:

0 to 5 inches, light brownish-gray very stony loam; massive, but breaks to moderate, fine, granular structure; soft when dry, friable when moist, slightly sticky and slightly plastic when wet; slightly acid.
5 to 15 inches, pale-brown, very stony loam; massive but breaks to moderate, fine, granular structure; soft when dry, friable when moist, slightly sticky and slightly plastic when wet; slightly acid.
15 inches +, white, massive, rhyolitic tuff that is fractured and weathered.

Approximately 40 percent of the soil mass consists of angular rocks and rounded stones. Depth to weathered tuff ranges from 10 to 24 inches. In small depressional areas on ridges, the subsoil is slightly finer textured than described and grades to light clay loam. The surface layer ranges from light brownish gray to grayish brown and is 5 to 10 inches thick. In places the areas consist of Rock land, which is mostly rock.

This soil is excessively drained. Permeability is moderate. The available water holding capacity is low, root penetration is shallow, and fertility is moderate to low. Runoff is rapid to very rapid, and the erosion hazard is severe to very severe.

This soil is used mostly for range, and yields are low. In most places the thin stands of commercial pine have

been logged off, and some areas have reverted to brush. This soil is in a zone that is transitional between natural forest and farm woodland. Capability unit VIs–4(22); woodland suitability group 9.

Jiggs Series

The Jiggs series consists of somewhat excessively drained, moderately deep, rocky, and loamy soils. These soils formed in hard, vitreous, rhyolitic tuff. They are strongly sloping to very steep and are on sidehills, mainly in the north-central part of the Area near Fiddletown. The vegetation is a mixture of brush, oak, and scattered conifers.

The surface soil is grayish-brown to pale-brown gravelly loam 5 to 10 inches thick. The subsoil is generally light yellowish-brown to brown cobbly heavy loam, but in places it is clay loam. It is 15 to 25 inches thick, slightly acid, and massive in most places. Depth to bedrock ranges from 24 to 40 inches. In places as much as 50 percent of the profile consists of rock fragments. The soil rests abruptly on pale-white or creamy, hard, fractured, rhyolitic tuff, particularly near the crest of ridges. In places on foot slopes these soils overlie unrelated schist, slate, granodiorite, or other rock because of downhill movement of the soil. These soils vary greatly in depth, color, and texture because of mixing of the materials through downhill movement and because of the variety of parent materials. Outcrops of horizontally bedded tuff are common.

Jiggs soils are used mostly for range, but in a few places conifers are cut for lumber. Many areas have thick stands of brush on them. Rocks and steep slopes restrict the use of these soils for cultivated crops.

Jiggs very rocky loam, 16 to 51 percent slopes (JgE).—This is the only unit of the Jiggs series mapped in this Area. It is on the sides of hills under brush and grass.

Representative profile with a slope of 30 percent:

0 to 7 inches, light brownish-gray to grayish-brown gravelly loam; granular structure; friable; slightly sticky and plastic when wet; medium acid.
7 to 48 inches, light yellowish-brown to brown cobbly heavy loam; massive; sticky and slightly plastic when wet; medium acid to strongly acid.
48 inches +, white, hard, fractured, rhyolitic tuff.

The surface layer ranges from grayish brown to pale brown in color and from loam to sandy loam in texture. The subsoil ranges from heavy sandy loam to clay loam. In places it is affected by seepage water and contains brownish-yellow or pale-brown mottles. Near bedrock the subsoil is nearly white or pale yellow in places. Rock fragments in the profile range from 20 to 50 percent, by volume, and from gravel to cobblestones or larger in size.

This soil is well drained. The available water holding capacity is moderate, root penetration is moderately deep, and fertility is low to moderate. Runoff is medium to very rapid, and the erosion hazard is moderate to very severe.

This soil has limited value for grazing by livestock and wildlife. Conifers scattered over the areas are cut for lumber. Capability unit VIs–81(22); woodland suitability group 8.

Josephine Series

The Josephine series consists of well-drained, deep to moderately deep, gravelly or rocky soils formed in tilted slate and schist. These soils are gently sloping to very steep. They are in the eastern part of the Area on hills, ridges, and the sides of mountains at elevations of 1,200 to 5,000 feet. Conifers, hardwoods, brush, and grass make up the vegetation.

The surface soil, a reddish-brown to yellowish-red loam or silt loam, is friable, massive to granular, and slightly acid to medium acid. The subsoil is brown to reddish-yellow and red clay loam or silty clay loam. It is medium acid to very strongly acid. Bedrock is at a depth between 24 and 70 inches. These soils generally have fragments of slate in the profile or rock outcrops on the surface.

Josephine soils are used mostly for timber. Most areas are used as summer range for cattle, but some are used for grazing sheep and goats. Areas below the snowline are used for light grazing the year round. Small areas are intermittently cropped to hay or grain, mostly to provide supplemental feed for use on the farm. A small acreage is planted to orchards of pears, apples, and walnuts for family use.

Josephine very rocky loam, 16 to 51 percent slopes (JoE).—This moderately steep to steep soil, the most extensive of the Josephine series, is on ridges and side slopes.

Typical profile under conifers and browse:

1 inch or less of fresh pine needles, oak leaves, and twigs that are partly decomposed in the lower part.
0 to 9 inches, brown, gravelly loam; massive, but breaks to fine subangular blocky structure; slightly hard when dry, friable when moist, slightly sticky and slightly plastic when wet; slightly acid.
9 to 37 inches, brown gravelly silty clay loam or clay loam; moderate, medium, subangular blocky structure; hard to very hard when dry, friable to firm when moist, sticky and plastic when wet; strongly acid; 25 percent of the lower 15 inches consists of fragments of schist.
37 to 47 inches, about half of this layer is rock fragments mixed with yellowish-brown silty clay loam or clay loam; very strongly acid.
47 to 68 inches +, brownish-yellow, yellowish-red, and gray, decomposed schist.

The color of this soil varies considerably. The surface soil is reddish brown to brown, or yellowish brown, and the subsoil is brown to reddish yellow and red. Fragments of schist make up a large part of the soil profile. Vertically inclined schist and slate extend into the subsoil and in places cover from 5 to 20 percent of the surface. Depth to weathered bedrock varies widely within short distances because of differences in the mineral composition, hardness, and angle of incline of the material to the surface. Generally, depth to weathered bedrock ranges from 24 to 40 inches. The texture also reflects the size of mineral grains in the bedrock. The surface soil is loam or silt loam, and the subsoil is silty clay loam or clay loam. Some areas are moderately eroded. In these places the soil has lost as much as 50 percent of its original surface soil and commonly has more gravel on the surface than areas that are not eroded.

This soil is well drained. Permeability of the surface soil is moderate, and that of the subsoil is moderately slow. The available water holding capacity is moderate, and root penetration is moderately deep. Fertility is moderate in most places, but it is low in areas that are moderately eroded. Runoff is medium to very rapid, and the erosion hazard is moderate to very severe.

Josephine very rocky loam, 16 to 51 percent slopes, is used mostly for timber and light grazing by livestock.

Trees on it grow at a moderate rate and are of good quality. Areas that have dense stands of brush are used as protected watershed. In some places at lower elevations, the soil has been cleared and is used for grazing by cattle, sheep, and goats. Control of brush and other woody plants is difficult because these plants regrow in a few years after the areas are cleared of them. Capability unit VIs–81(22); woodland suitability group 7.

Josephine loam, deep, 9 to 16 percent slopes (JnC).—This strongly sloping soil occupies the lower part of foot slopes and smooth ridges in mountainous areas. The surface layer ranges from 12 to 18 inches in thickness, and the subsoil from 25 to 40 inches. Depth to bedrock ranges from 48 to 70 inches. Generally, small fragments of slate or schist are in the profile in most places, but their number is fairly small. The soil has high water-holding capacity. Root penetration is deep. Runoff is medium, and the erosion hazard is moderate.

This soil, the best of the Josephine series, is used mainly for timber, though it is grazed in some places. The grazing is largely browse in timbered areas and grass in open areas. If this soil is well managed, trees on it grow rapidly and are of high quality. Small, gently sloping areas are cleared and used for dry-farmed hay, grain, pasture, and orchard crops. All of these crops respond if fertilizer that contains nitrogen and phosphate is applied. Some areas are irrigated with water stored in small farm reservoirs. The soil should be cultivated across the slope or on the contour. Capability unit IIIe–1(22); woodland suitability group 1.

Josephine loam, deep, 16 to 31 percent slopes (JnD).—This moderately steep soil is on slopes and ridges. Except that it is less sloping and is moderately eroded in more areas, it is similar to Josephine loam, deep, 9 to 16 percent slopes. Runoff is rapid, and the erosion hazard is moderate to severe.

If this soil is well managed, it is among the most productive soils in the Area for timber, and it is used mostly for that purpose. Harvesting of trees is difficult, however, and care is required to protect this soil from erosion. Some areas are cleared and used mostly for grazing or are used periodically for hay and grain. The erosion hazard is severe if the soil is cultivated. Consequently, this soil should be protected by some kind of vegetation, or if it is cultivated, practices should be used that will help control erosion. Capability unit IVe–1(22); woodland suitability group 3.

Josephine loam, deep, 31 to 51 percent slopes (JnE).—This steep soil is on slopes and ridges in mountainous areas and in areas dissected by creeks and streams. The surface soil is thinner than in the more gently sloping Josephine soils; it ranges from 6 to 10 inches in thickness. Depth to bedrock is 30 to 60 inches. Runoff is very rapid, and the erosion hazard is severe to very severe. This soil is too steep for cultivation. It is well suited to timber, and it is used primarily for that purpose or is lightly grazed by livestock. Some cleared areas support fair stands of annual grass and, in some places, of perennial grass. Open areas are difficult to maintain and are commonly invaded by brush, mountain misery, or bracken fern. Capability unit VIs–1(22); woodland suitability group 3.

Josephine very rocky loam, deep, 16 to 51 percent slopes (JpE).—This moderately steep to steep soil is in mountainous areas. Angular, slaty rock outcrops occupy from 10 to 25 percent of the surface in places. Rock fragments are abundant throughout the profile. In a large acreage, the surface soil is reddish brown and the subsoil is red. Runoff is rapid to very rapid, and the erosion hazard is moderate to very severe.

Steep slopes and rocks make cultivation of this soil impractical. Consequently, all of the soil is used for timber and for grazing. This soil is productive of timber, but good management is required for maximum yields, and logging should be carefully done. Cleared areas are used for grazing. Capability unit VIs–1(22); woodland suitability group 3.

Josephine very rocky loam, deep, 51 to 71 percent slopes (JpF).—Areas of this very steep soil are on slopes that grade to rivers, streams, and smaller drainageways. The surface soil is reddish brown or yellowish red and is thin in places. It ranges from 6 to 8 inches in thickness. The subsoil is brown, reddish-yellow, or red clay loam or silty clay loam. Depth to bedrock ranges from 30 to 60 inches. In most places the soil is very rocky. Runoff is very rapid, and the erosion hazard is very severe.

This soil is used solely for timber and light grazing. Special practices are required in logging. If logging roads are built, providing drainage for runoff water, or ditches to turn the water away from the roads, helps prevent severe erosion. Capability unit VIIs–1(22); woodland suitability group 4.

Josephine loam, 3 to 16 percent slopes (JmC).—This soil is in bottoms or on foot slopes in undulating to rolling areas. Its surface soil is 5 to 10 inches thick, and the solum is 15 to 30 inches thick. Depth to bedrock ranges from 24 to 40 inches. There are some angular rock fragments in this soil, but the areas are relatively free of rock outcrops.

The water-holding capacity of this soil is moderate, and root penetration is moderately deep. Runoff is medium. The erosion hazard is moderate.

Most of this soil is used for timber. Cleared areas are used for grazing or for hay and grain crops. A small acreage is planted to grapes (fig. 19) or to orchards. These crops respond to fertilizer that contains nitrogen and phosphate. If this soil is cultivated, farming should

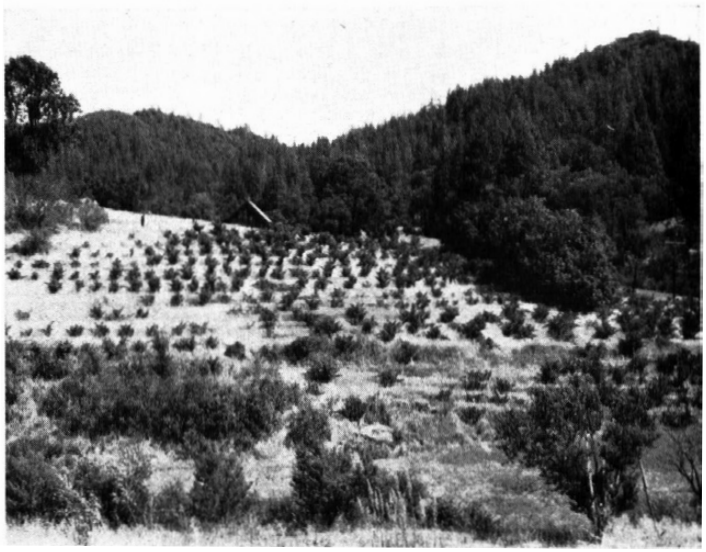

Figure 19.—**Dry-farmed vineyard on a Josephine loam.**

be on the contour or across the slope. Capability unit IIIe–8(22); woodland suitability group 5.

Josephine loam, 16 to 31 percent slopes (JmD).—This moderately steep soil is on slopes and ridges. It is fairly free of rock outcrops, but it is otherwise similar to Josephine very rocky loam, 16 to 51 percent slopes. Runoff is moderate to rapid, and the erosion hazard is moderate to severe.

Most of this soil is used for timber, but minor areas are planted to hay and grain, to vineyards, or to orchards. Some cleared areas are used solely for grazing. Areas in brush serve as a protected watershed. Capability unit IVe–8(22); woodland suitability group 6.

Josephine loam, 31 to 51 percent slopes (JmE).—Steep, slightly convex mountainous slopes make up areas of this soil. The soil is similar to Josephine very rocky loam, 16 to 51 percent slopes, but it is fairly free of rock outcrops and somewhat more sloping. Runoff is very rapid, and the erosion hazard is very severe.

This soil is suited mainly to timber. If it is well managed, trees on it grow at a moderate rate and are of good quality. Capability unit VIs–81(22); woodland suitability group 6.

Josephine very rocky loam, 3 to 16 percent slopes (JoC).—This gently sloping to strongly sloping soil is in concave swales or on foot slopes. Rock outcrops occupy 5 to 20 percent of the surface area. Runoff is medium, and the erosion hazard is moderate.

Because of outcrops of bedrock and numerous stones, this soil is not well suited to cultivation. It is productive of timber and is best kept in timber. Capability unit VIs–8(22); woodland suitability group 5.

Josephine very rocky loam, 51 to 71 percent slopes (JoF).—This very steep soil is in mountainous areas and on sharp breaks to rivers and streams. Depth to bedrock varies considerably. It generally increases on the lower part of foot slopes; but on the upper rims of canyons or ridges, it is less than 20 inches in some places. Loose rock is abundant throughout the profile, and numerous rock outcrops are on the surface. Runoff is very rapid, and the erosion hazard is very severe.

In some places the soil is shallow to bedrock. On foot slopes, the soil has a subsoil of red clay in places.

Josephine very rocky loam, 51 to 71 percent slopes, is used only for timber and for light grazing. Special logging practices that help prevent serious erosion are needed. Capability unit VIIs–81(22); woodland suitability group 8.

Josephine-Mariposa complex, 16 to 51 percent slopes (JxE).—About 50 percent of this mapping unit consists of Josephine very rocky loam, 16 to 51 percent slopes, and about 30 percent of Mariposa very rocky loam, 31 to 51 percent slopes. The rest is mostly Sites soils and small areas of Maymen and Fiddletown soils.

This complex is used mostly for timber; the open or cleared areas are used for light grazing. Conifers do better on the Josephine soils than on the Mariposa. The Josephine very rocky loam is in capability unit VIs–81(22) and woodland suitability group 7. The Mariposa very rocky loam is in capability unit VIs–4(22) and woodland suitability group 9.

Josephine-Mariposa complex, 51 to 71 percent slopes (JxF).—About 50 percent of this mapping unit consists of Josephine very rocky loam, 51 to 71 percent slopes, and about 50 percent of Mariposa very rocky loam, 51 to 71 percent slopes. The rest is mostly Sites soils and small areas of Maymen and Fiddletown soils. This complex has very steep slopes and is on prominent ridges and side slopes.

Areas of this complex are used mostly for timber and limited grazing. Dense, brushy areas serve as protected watershed or as browse areas for wildlife. Capability unit VIIs–81(22); the Josephine very rocky loam is in woodland suitability group 8, and the Mariposa very rocky loam is in woodland suitability group 9.

Josephine-Maymen complex, 16 to 51 percent slopes (JsE).—This mapping unit consists of Josephine very rocky loam, 16 to 51 percent slopes, and of Maymen very rocky loam, 16 to 51 percent slopes.

This complex is used for wildlife and as protected watershed. In pockets of deeper soil, pines grow in places and are harvested for lumber. Cleared or open areas are used for grazing. The Josephine very rocky loam is in capability unit VIs–81(22) and woodland suitability group 7. The Maymen very rocky loam is in capability unit VIIs–4(22) and woodland suitability group 9.

Laniger Series

In the Laniger series are moderately deep, sandy loams. These soils formed in pale, rhyolitic tuff that was moderately to strongly consolidated. They are nearly level to strongly sloping and are in drainageways and on the sides of hills at elevations from 200 to 500 feet. These soils are in the southwestern part of the Area and occupy a belt that runs from the northwest to the southeast. The vegetation is predominantly grass-oak but includes a few scattered digger pines and some brush.

The surface soil, a light brownish-gray to pale-brown sandy loam, is medium acid. The subsoil is light brownish-gray to nearly gray sandy loam. At a depth between 24 and 45 inches, the subsoil is underlain abruptly by very pale brown to light-gray rhyolitic tuff. The tuff is extremely hard when dry and has the appearance of sandstone in place. In some places the parent material weathers directly to clay and forms a lens about 3 to 7 inches thick. Laniger soils are generally free of rocks, but in some places they have a mantle of unrelated gravelly or cobbly alluvium.

Laniger soils are used for livestock grazing, principally cattle. In years when rainfall is well distributed, yields of forage are fair. A small acreage is occasionally planted to hay and grain.

Laniger sandy loam, 2 to 16 percent slopes (LaC).—This soil, the most extensive of the Laniger series, is on flats, foot slopes, and the sides of hills. It generally adjoins areas of Pentz soils on shallow ridges.

Representative profile under grass:

0 to 12 inches, light yellowish-brown or pale-brown sandy loam; generally massive, but in places has weak platy structure; weakly coherent when dry, very friable when moist; porous; slightly acid to medium acid.

12 to 34 inches, light-gray or light yellowish-brown coarse sandy loam; massive; loose when dry or moist; porous; medium acid to strongly acid.

34 inches +, consolidated light-gray to white, rhyolitic tuff; roots penetrate only in cracks.

The texture of the surface soil ranges from coarse sandy loam to fine sandy loam. The upper part of the surface layer contains organic matter and is somewhat darker than the subsoil. In places the profile contains a mod-

erate amount of gravel and cobblestones. Here the soil is reddish brown in places, especially in areas that adjoin soils of the Pardee or Red Bluff series. Gently sloping areas are hummocky in places. Where the soil is in narrow stringers in the bottom of drainageways, it generally has a mottled subsoil, is loam to clay loam in texture, and is somewhat wetter than in higher areas on side slopes. In places the soil is shallow to bedrock, but generally, depth to bedrock ranges from 18 to 45 inches. In places the upper boundary of the bedrock weathers to clay.

This soil is mostly well drained. Permeability is moderately rapid down to the bedrock. The available water holding capacity is moderate to low, root penetration is moderately deep, and fertility is low. Runoff is slow to moderate, and the erosion hazard is slight to severe.

Although this soil is used mostly for grazing, some areas are used for dry-farmed hay and grain. Reseeding with desirable grasses and legumes and adding fertilizer that contains nitrogen and phosphate improves deteriorated rangeland. If this soil is used for crops, farming across the slope, stripcropping, and other practices that help control erosion are needed on the upper part of the slopes. The soil is subject to severe erosion if left bare or finely tilled during the rainy season. Capability unit IVe–8(18); range site 6.

Laniger sandy loam, thick surface, 0 to 5 percent slopes (LgB).—Characteristically, this soil has a surface layer that is very dark brown to very dark grayish brown when moist and 12 to 18 inches thick, but it is otherwise similar to Laniger sandy loam, 2 to 16 percent slopes. The subsoil is brown to pale brown when moist and 12 to 24 inches thick. In places it has iron staining and mottling caused by seepage from side slopes and entrapment of water above the bedrock. Weathered rhyolitic tuff, or in places clay, is at a depth between 20 and 45 inches.

This soil is well drained to moderately well drained, and the available water holding capacity is moderate. Runoff is slow to moderate. Plant-soil-moisture relationship is generally favorable and prolongs until late in spring the period when green annual grasses can be grazed. In excessively wet years, however, growth of forage is slow and yields are reduced if the soil is saturated for long periods.

A small acreage of this mapping unit consists of soils that are reddish brown, gravelly or cobbly, and less than 20 inches deep to bedrock. In places the soil is very strongly acid in the lower part of the subsoil.

Laniger sandy loam, thick surface, 0 to 5 percent slopes, is used mainly for grazing of cattle. Grasses on it respond well if fertilizer that contains nitrogen and phosphate is applied. Capability unit IIIw–3(18); range site 6.

Limestone Rock Land (Ln)

This miscellaneous land type consists chiefly of outcroppings of recrystallized limestone or marble. Between the rocks are small areas of very thin, stony, loamy soil material. Some areas apparently capped by gravel were hydraulically mined during the time of the gold rush. Areas of this land type are marked by white or grayish marble, which stands like spires on the brush-covered hillsides. This land type is inextensive and is mainly near Volcano, but isolated areas occur as far north as Fiddletown. The areas are adjacent to the Tiger Creek soils, which are reddish-brown, moderately deep soils that formed in material from limestone. Sparse stands of conifers, brush, hardwoods, and grass make up the vegetation.

Limestone rock land is excessively drained. Permeability is rapid. The available water holding capacity is very low, root penetration is very shallow, and fertility is low. Runoff is very rapid, and the erosion hazard is very severe.

Most areas of this land type consist of bare rock. Consequently, it has little value, except as watershed areas and as areas for wildlife. The limestone is used to manufacture Portland cement and other products. Capability unit VIIIs–8(22).

Loamy Alluvial Land (Lo)

In this miscellaneous land type are small, narrow stringers of recent alluvium laid down adjacent to streams or behind dams of mining debris across small creeks and drainageways. The alluvium consists of loamy, stratified material washed from different soils derived from various kinds of rock. The elevation is generally more than 1,500 feet. The vegetation is mainly grass-forb but includes a few conifers and hardwoods.

The soils in this land type are brown or reddish brown and deep to moderately deep. In places they are underlain by debris from placer mining. Stratified layers of sand, silt, and gravel are common in some places. The soil material closely resembles that of the Honcut soils, which are at lower elevations.

Loamy alluvial land is well drained. Permeability is variable, but it is moderate in most places. The available water holding capacity is high, root penetration is deep to very deep, and fertility is high. These soils are easy to work. Runoff is slow, and some areas adjacent to streams are flooded sometimes by overflow from the streams.

The soils in this land type are productive. The areas are used for small home gardens, orchards, and irrigated pasture. The pastures are small, but they provide valuable supplemental feed for livestock in the steep, mountainous uplands. Annual grasses and forbs are on the areas not cropped, and these areas are generally bordered by oaks and conifers, or by alders, willows, and maples. Capability unit IIe–1(22); range site 1; woodland suitability group 1.

Made Land (Ma)

This miscellaneous land type consists of stratified, moderately deep, well drained to moderately well drained soils that were dredged or otherwise disturbed by mining. It is mostly nearly level and is on flats and bottoms mainly in the northwestern part of the Area. Some gently sloping areas are hummocky as the result of mining debris that has collected on them. In most places the surface soil was stripped and placed in windrows to expose the gravel that contained gold. After working the gravel, both the fine clayey material removed in the sluicing process and the gravel were placed at the bottom of the mine pit, and then the original surface soil was laid down over the fine material and gravel. The vegetation is mostly annual grass, dock, and tarweed, but it includes a few scattered oaks.

The surface soil is mostly reddish-brown to dark-brown loamy or sandy material that is relatively free of gravel

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and is slightly acid to medium acid. The subsoil is highly variable, gravelly or cobbly clay loam and clay. It is nearly neutral. The very cobbly or gravelly substratum generally is at a depth between 30 and 40 inches. Some areas of this land type have been rough leveled, and others have been left with a hummocky surface.

The soils in this land type are well drained to moderately well drained. Permeability is variable, but it is mostly moderate in the surface soil and slow in the subsoil. The available water holding capacity is moderate, root penetration is moderately deep, and fertility is low. Runoff is slow. The erosion hazard is none to slight.

Included with this land type in mapping are small areas of Auburn soils and of Exchequer soils. Also included are small areas of Mine tailings and Riverwash.

Made land is used mostly for grazing, and yields of annual forage are fair. Some areas are suited to irrigated pasture or other shallow-rooted crops. Yields of range increase if fertilizer that contains nitrogen and phosphate is applied. Capability unit IVe–39(18); range site 4.

Mariposa Series

The soils of the Mariposa series are well drained, shallow, and gravelly or rocky. These soils formed in weathered schist and slate. They are moderately sloping to very steep. They are on ridges and adjacent slopes in the eastern part of the survey Area at elevations from 1,200 to 5,000 feet. Conifers, hardwoods, brush, and grass make up the vegetation.

The surface soil, a pale-brown, yellowish-brown, or grayish-brown gravelly loam or silt loam, is slightly acid to medium acid. The subsoil is yellowish-brown to yellowish-red, or in places pink, light clay loam or silty clay loam. It is medium acid to strongly acid. Depth to bedrock ranges from 10 to 26 inches, but this varies greatly within short distances because of the nearly vertical bedding of the rock and the varying hardness of the strata. In most places rock outcrops occupy from 15 to 25 percent of the surface. Gravel, cobblestones, and other stones make up 15 to 30 percent of the soil mass, by volume.

Mariposa soils are used mostly for timber. Some areas, chiefly those at elevations of less than 2,500 feet, are cleared and used for grazing cattle, sheep, and goats. Areas with dense stands of brush are used primarily as protected watershed and as browse areas for wildlife. Conifers on these soils grow slowly and produce low-grade lumber.

Mariposa very rocky loam, 31 to 51 percent slopes (McE).—This soil, the most extensive in the Mariposa series, is on steep ridge crests and south-facing slopes, generally on the eastern belt of the Calaveras formation. In some places the soil is moderately eroded, particularly on narrow ridges.

Representative profile under brush, oak, and pine:

1½ inches or less of loose litter, mainly of manzanita and oak leaves, but that includes some pine needles; partly decomposed in the lower part.
0 to 4 inches, pale-brown to light yellowish-brown gravelly loam; massive, but breaks to granular structure; soft when dry, friable when moist, slightly sticky and slightly plastic when wet; medium acid.
4 to 8 inches, pink gravelly loam; massive; slightly hard when dry, slightly firm when moist, plastic and slightly sticky when wet; strongly acid.
8 to 15 inches, similar to layer above but silty clay loam in texture.
15 to 23 inches, pink silt loam; massive; slightly hard when dry, firm when moist, slightly plastic and slightly sticky when wet; strongly acid.
23 to 36 inches, very pale brown, partly decomposed schist that has strong-brown stainings along fracture planes.

The surface soil is brown, pale-brown, dark-brown, or light yellowish-brown loam to silt loam. The subsoil is pink, red, light yellowish brown, or reddish brown and ranges from silty clay loam to clay loam. There are numerous loose rock fragments in the profile. Depth to bedrock ranges from 12 to 26 inches. Generally, pines are scattered on areas of this soil.

In areas that adjoin the Exchequer and Auburn soils, this soil is in some places medium acid throughout the profile. In places from 15 to 26 percent of the surface consists of rock outcrops.

This soil is well drained. Permeability is moderate. The available water holding capacity is low. Root penetration is mostly shallow, but in places large tree roots penetrate through fractures deeper into the bedrock. Fertility is low to moderate. Runoff is very rapid, and the erosion hazard is very severe.

The soil is moderately deep or deep to bedrock and similar to the Josephine soils in places.

Mariposa very rocky loam, 31 to 51 percent slopes, is used for timber and some grazing. Cleared areas are used for grazing. Most areas are cut over and are commonly invaded by brush. Trees on this soil grow fairly rapidly until they reach between 30 and 50 years of age, but their growth slows when the roots reach bedrock. Because of shallow rooting, the hazard of windthrow is severe. Capability unit VIs–4(22); woodland suitability group 9.

Mariposa gravelly loam, 3 to 31 percent slopes (MbD).—This gently sloping to moderately steep soil is on ridges and slopes on the upper part of foothills or is on foot slopes in mountainous regions. It contains 15 to 25 percent of gravel, but it is fairly free of rock outcrops. In some places where the slope is gentle and the soil is affected by runoff water, or where the soil formed in material from dark-colored slate, the surface soil is grayish brown. In cleared areas at lower elevations, where the soil is under grass, the soil is generally slightly acid to medium acid throughout the profile. Runoff is medium to rapid, and the erosion hazard is moderate to severe.

A small acreage of this soil is moderately deep to deep to bedrock in places.

Large areas of Mariposa gravelly loam, 3 to 31 percent slopes, have been cleared and used for grazing. Gently sloping areas are periodically cropped to hay and grain in places. The rest of the acreage supports conifers and hardwoods that are cut for poles, fenceposts, and firewood. Capability unit IVe–84(22); woodland suitability group 9.

Mariposa very rocky loam, 9 to 31 percent slopes (McD).—This soil is on strongly sloping hills and moderately steep ridges and slopes. Except for gentler slopes, it is similar to Mariposa very rocky loam, 31 to 51 percent slopes. In places on ridge crests, the soil is very shallow and is dark grayish brown. Runoff is rapid, and the erosion hazard is severe.

Most of this soil is used for timber and some grazing. Areas that are cleared are used mostly for grazing. The soil is generally too rocky for cultivation. Brushy areas are used as protected watershed and as browse areas for

wildlife. Capability unit VIs–4(22); woodland suitability group 9.

Mariposa very rocky loam, 51 to 85 percent slopes (McF).—A large acreage of this very steep soil is on slopes that drop into canyons of the Mokelumne or Cosumnes Rivers; other areas are in mountainous regions. This soil is very rocky and contains numerous slaty fragments. Depth to bedrock ranges from 10 to 20 inches. In places on ridge crests, the soil is very shallow, dark grayish-brown very rocky loam.

This soil is well drained to somewhat excessively drained. Runoff is very rapid, and the erosion hazard is very severe.

Generally, this soil is best maintained as protected watershed or used for wildlife or recreation. In some places the trees can be cut for firewood, poles, and fenceposts, but adequate vegetation should be left for soil protection. Special logging practices are needed in logging conifers that grow in small pockets of this soil. Capability unit VIIs–41(22); woodland suitability group 9.

Mariposa-Maymen complex, 16 to 51 percent slopes (MdE).—This mapping unit consists of Mariposa very rocky loam, 16 to 51 percent slopes, and of Maymen very rocky loam, 16 to 51 percent slopes.

Some of the deeper areas of this complex have pockets that produce conifers that can be used for lumber. The very shallow Maymen part generally is covered with dense stands of brush and is used as protected watershed. The Mariposa very rocky loam is in capability unit VIs–4(22), and the Maymen very rocky loam is in capability unit VIIs–4(22); both are in woodland suitability group 9.

Mariposa-Maymen complex, 51 to 85 percent slopes (MdF).—This mapping unit consists of Mariposa very rocky loam, 51 to 85 percent slopes, and of Maymen very rocky loam, 51 to 85 percent slopes.

The soils in this complex have somewhat limited value for agriculture. They are used as watershed areas or for wildlife or recreational purposes, to which they are best suited. Conifers grow in small pockets of soil and can be logged only with difficulty. Capability unit VIIs–41(22); woodland suitability group 9.

Maymen Series

In the Maymen series are somewhat excessively drained, very shallow, very rocky, dark grayish-brown soils. These soils formed in dark, tilted quartzitic schist and fine-grained slate. They are strongly sloping to steep. Maymen soils are on hills and ridge crests in the eastern part of the Area in the upper part of foothills or mountains at elevations of 1,200 to 3,500 feet. The vegetation is mainly brush, but it includes sparse stands of grass and scattered hardwoods and conifers.

The surface soil is dark grayish-brown very rocky loam and is medium acid. Depth to bedrock is 2 to 10 inches. Angular slaty fragments make up about 30 percent of the soil mass. Rock outcrops are common.

Maymen soils are used mainly as protected watershed or as wildlife areas. Cleared areas provide limited grazing for cattle, sheep, or goats. The oaks are cut for firewood, and the conifers are cut for poles or fenceposts.

Maymen very rocky loam, 9 to 51 percent slopes (MgE).—This is the only soil mapped separately in the Maymen series in this Area. It is very shallow to bedrock and is on ridge crests and steep hillsides.

Representative profile under annual grass in an area cleared of brush:

0 to 7 inches, dark grayish-brown very rocky loam; granular; soft when dry, friable when moist, slightly sticky and plastic when wet; medium acid.
7 inches +, irregular, vertically tilted, fine-grained slate.

The color of the surface soil ranges from very dark brown to dark grayish brown or reddish brown. Depth to bedrock ranges from 2 to 10 inches. Numerous, loose, slaty pebbles are in the profile. Angular rock outcrops are on the surface. In most places the soil is moderately eroded.

This soil is somewhat excessively drained. Permeability is moderate. The available water holding capacity is very low, root penetration is very shallow, and natural fertility is low. Runoff is very rapid, and the erosion hazard is severe to very severe.

In some areas this soil is shallow to moderately deep over bedrock. Very steep areas consist of Rock land.

Maymen very rocky loam, 9 to 51 percent slopes, has limited value for agriculture. Areas under a dense cover of brush are best maintained as protected watershed. Areas that are cleared provide some grazing, but yields of forage are low, and the forage matures quickly with the first warm weather in spring. In places conifers and hardwoods provide firewood, fenceposts, and poles. Capability unit VIIs–4(22); woodland suitability group 9.

Maymen-Mariposa complex, 16 to 51 percent slopes (MhE).—This mapping unit consists of Maymen very rocky loam, 16 to 51 percent slopes, and of Mariposa very rocky loam, 16 to 51 percent slopes.

This complex is used mainly as watershed and wildlife areas. It has only limited value for grazing and timber. The Maymen very rocky loam is in capability unit VIIs–4(22), and the Mariposa very rocky loam is in capability unit VIs–4(22); both are in woodland suitability group 9.

McCarthy Series

The McCarthy series consists of well-drained, moderately deep to deep, cobbly, and rocky soils. These soils formed in volcanic conglomerate. They occupy moderately sloping tabular ridges and moderately steep to very steep side slopes in the eastern part of the Area at elevations of 2,000 to 5,000 feet. Conifers, hardwoods, brush, and grass make up the vegetation.

The surface soil is dark-brown to dark grayish-brown cobbly loam. It is very friable and is slightly acid to medium acid. The subsoil is similar to the surface soil, but its color ranges from that of the surface soil to yellowish red in the deep soils. Rounded cobblestones, dominantly between 5 and 10 inches in diameter, are in the surface soil in most places and generally are more abundant with increasing depth. Depth to weathered conglomerate is 18 to 60 inches or more.

McCarthy soils are used mainly for timber. Some areas at elevations of less than 3,000 feet and under thin, mostly open stands of conifers are grazed. Cobblestones generally are so numerous it is impractical to cultivate these soils.

McCarthy very cobbly loam, 3 to 16 percent slopes (MlC).—This gently sloping to strongly sloping soil is on tabular ridges and adjacent side slopes.

Representative profile under grass, scattered conifers, and brush:

0 to 21 inches, dark grayish-brown very cobbly loam; moderate, very fine granular structure; soft when dry, very friable when moist; medium acid; contains 5 to 15 percent of rounded cobblestones, by volume.
21 to 31 inches, similar to layer above, but contains as much as 40 percent of rounded cobblestones, by volume.
31 inches +, yellowish-brown, weathered conglomerate.

The surface soil is strong brown to very dark brown and 5 to 22 inches thick in some places. The subsoil is dark grayish brown to yellowish brown and is 15 to 25 inches thick. Depth to weathered bedrock ranges from 20 to 50 inches. Outcroppings of massive conglomerate occur in some areas.

This soil is well drained. Its permeability and available water holding capacity are moderate. Root penetration is moderately deep, and fertility is moderate. Runoff is slow to medium. The erosion hazard is moderate.

Included with this soil in mapping are areas of Rock land or of Iron Mountain very stony loam that are shallow or very shallow over bedrock. Also included are areas of deep Cohasset very cobbly loam.

McCarthy very cobbly loam, 3 to 16 percent slopes, is used for grazing, but it has some value for timber. The trees have been logged off most areas, and young pines and other conifers have regrown in some places. Brushy areas are used as protected watershed or wildlife browse areas. On this soil, trees of good quality grow at a medium rate. Capability unit VIs–8(22); woodland suitability group 5.

McCarthy very rocky loam, 16 to 51 percent slopes (MkE).—Most of this soil is at elevations of more than 4,000 feet. The soil material consists of colluvium that washed or rolled from soils on higher ridges of volcanic conglomerate onto these moderately steep to steep slopes underlain by granitic rock. Outcroppings of granite and diorite occur in some areas, but these materials have had little effect on the formation of this soil.

The surface soil is dark brown to yellowish red and 10 to 20 inches thick. Generally, the subsoil is reddish brown and 20 to 40 inches thick. There is little textural difference between the two layers. Depth to bedrock ranges from 48 to more than 60 inches. The vegetation is mostly conifers and hardwoods.

This soil has high water-holding capacity. Root penetration is deep. Runoff is medium to very rapid, and the erosion hazard is moderate to very severe.

Included with this soil in mapping are areas of Josephine very rocky loam, of Holland very rocky coarse sandy loam, and of Shaver very rocky coarse sandy loam.

McCarthy very rocky loam, 16 to 51 percent slopes, has limited use for crops. The climate is unfavorable, and the soil is too rocky for cultivation. It is therefore used mostly for timber. Under good management, this soil produces rapid-growing trees of high quality. Capability unit VIs–1(22); woodland suitability group 3.

McCarthy very rocky loam, 51 to 71 percent slopes (MkF).—This very steep soil is at elevations of more than 4,000 feet. The vegetation is mostly conifers and hardwoods, but it includes some brush. Except for its steeper slopes, this soil is similar to McCarthy very rocky loam, 16 to 51 percent slopes. Runoff is very rapid, and the erosion hazard is very severe.

This soil is used for timber. Trees of good quality grow rapidly on this soil, but they can be logged only if special methods are used. This soil is highly erodible if poorly managed, or if the vegetation is destroyed by fire. Capability unit VIIs–1(22); woodland suitability group 4.

McCarthy and Jiggs very cobbly loams, 16 to 51 percent slopes (MmE).—This mapping unit consists of McCarthy very cobbly loam, 16 to 51 percent slopes, and of Jiggs very cobbly loam, 16 to 51 percent slopes, in variable proportions. The soils in this undifferentiated unit are strongly sloping to steep. They are on hills and side slopes that adjoin tabular ridges. In some places chunks of conglomerate or stones as much as 16 inches in diameter are on the surface. Runoff is rapid to very rapid, and the erosion hazard is severe to very severe.

This unit is used for grazing and for timber. Most areas were cut over and are now stocked with seedlings or are under a cover of second-growth trees. Good stands of grass mixed with brush and hardwoods are on open areas. Trees of good quality can be grown on this unit, and conifers should be encouraged. The McCarthy very cobbly loam is in capability unit VIs–81(22) and woodland suitability group 7. The Jiggs very cobbly loam is in capability unit VIs–1(22) and woodland suitability group 8.

Mine Tailings and Riverwash (Mn)

Two-thirds of the acreage of this miscellaneous land type consists of cobblestones and larger stones and of sandy and gravelly material common to most river and other stream channels.

This land type is nearly level to gently sloping. Most of the material has been sluiced or dredged for gold and the material left in hummocky mounds or cobbly stringers along streams, but part of the material was laid down and reworked by floodwaters. The remainder of the areas consist of high mounds of cobblestones from dredging, of debris from ore-crushing operations, or of cobblestones and other stones from mining of ancient river channels that run under lava caps on ridges. The material that makes up this land type contains little fine soil material in most places. Except for a few trees, some brush, and small areas of grass, vegetation is sparse.

This land type has little value for agriculture. Drinking water for livestock can be obtained from the streams. Capability units VIIIs–8(18) and VIIIs–8(22).

Mixed Alluvial Land (Mo)

This miscellaneous land type consists of stratified, mostly well-drained soils formed in recent alluvium from various kinds of rock. The areas are on narrow stringers adjacent to streams, or in nearly level to gently sloping flats and swales. Much of the soil material is from mining operations. In most places the vegetation consists of grass in open areas bordered by conifers and hardwoods, or by alders, willows, and cottonwoods.

The surface soil is generally gravelly loam or sandy loam. The subsoil is highly variable. It is stratified with gravel, sand, and silt, or in a few places with clay. In some places the areas are channeled by floodwater.

Most of this land type is well drained, but some areas have a periodic high water table. Permeability of the surface soil is moderate to moderately rapid, and that of the subsoil is variable. The water-holding capacity is moderate to low, root penetration is deep, and fertility is moderate to high. Runoff is slow to medium. This

land type is subject to damage through deposition or channeling by floodwater.

Because of the flooding hazard and the irregular terrain, Mixed alluvial land is used mostly for grazing and for timber. Some nearly level areas are cropped to hay and grain. Most of the acreage is unimproved. Capability units IVw–2(18) and IVw–2(22); range site 1; woodland suitability group 1.

Mixed Wet Alluvial Land (Mp)

This miscellaneous land type consists of dark-colored, somewhat poorly drained to poorly drained, moderately fine textured to fine textured, meadowlike soils. The soils in this land type formed in alluvial deposits from various kinds of rock. The areas are in flats and swales and on low stream terraces, mostly at elevations of more than 1,600 feet. The vegetation is mainly sedges, grasses, and forbs that tolerate water, but it includes a few scattered white oaks and conifers. A small acreage consists of mountain meadow.

The surface soil is very dark gray clay loam or loam that is high in organic matter and is medium acid to slightly acid. In some places a thin mantle of reddish-brown to brown gravelly material, or other coarse-textured material, is on the surface. The subsoil is olive-gray to gray clay or heavy clay loam. It is plastic and medium acid, and it is generally gleyed or mottled.

This land type is subject to seepage and occasional flooding. The water table is generally less than 4 feet from the surface and seasonally is at or near the surface in places. In some places cobblestones or other large stones that have been deposited with the alluvium occur at varying depths. Depth to the heavy clay subsoil is less than 2 feet in places.

In places a small part of this mapping unit consists of material from adjoining upland soils that has been carried down from surrounding slopes.

Mixed wet alluvial land is somewhat poorly drained to poorly drained. Permeability of the surface soil is slow, and that of the subsoil is slow to very slow. The available water holding capacity is moderate to high, root penetration is moderately deep to deep, and fertility is moderate. Runoff is slow to very slow. The areas are subject to water erosion if flooded.

This land type is used mostly for pasture and for timber. Drainage is needed for improved pasture crops and other crops. The areas are small, and the soil material is difficult to work because of its heavy texture and wetness and because of occasional "floater" rocks in the material. Also, the unfavorable climate limits the crops grown. Capability units IVw–2(18) and IVw–2(22); range site 1; woodland suitability group 1.

Mokelumne Series

In the Mokelumne series are moderately well drained, strongly acid to very strongly acid, infertile soils. These soils formed partly in material from old sandstone and partly in clayey marine sediments. They are gently sloping to moderately steep. Mokelumne soils are in swales and on dissected terraces in the western part of the Area at elevations from 200 to 400 feet. The vegetation consists of fair to poor stands of grasses and forbs, of thin to dense thickets of oaks and digger pines, and in places, of dense stands of brush.

The surface soil is grayish-brown, brown, or light yellowish-brown sandy loam or coarse sandy loam that is friable and medium acid to very strongly acid. In some places it is platy in structure, and in others it is single grain or massive. This layer is porous and slightly hard to loose when dry. The subsoil is pale-brown, reddish-brown, or yellowish-brown sandy clay, clay, or silty clay that is very firm and columnar. It is strongly acid to extremely acid. In places the subsoil contains concretions of iron and manganese and thin, hard lenses cemented with iron. Depth to the clayey subsoil ranges from 10 to 25 inches. Relief is generally hummocky, especially where the slope is gentle.

Mokelumne soils are inextensive. Larger areas occur near the Red Bluff soils and near areas of Alluvial land; these are mapped in a complex with the Red Bluff soils and in an undifferentiated unit with Alluvial land.

Nearness of the clay subsoil to the surface, low fertility, and acidity limit the use of the Mokelumne soils for crops. They are therefore used mostly for grazing cattle. Yields of forage generally are low, and the quality of the forage is poor.

Mokelumne sandy loam, 2 to 5 percent slopes (MrB).—This gently sloping soil is in swales and on lower slopes of terraces. The relief is generally hummocky, and the soils on the higher hummocks are better drained and more productive than those in low areas. The low areas are seasonally wet for long periods, and here the soil is generally mottled.

Representative profile under annual grass:

0 to 1 inch, grayish-brown sandy loam; platy structure; soft when dry, friable when moist; medium acid.
1 inch to 13 inches, brown sandy loam; massive; slightly hard when dry, friable when moist; very strongly acid.
13 to 14 inches, light-gray sandy clay loam; massive; hard when dry, friable when moist, sticky and plastic when wet; strongly acid.
14 to 22 inches, pale-brown sandy clay with brown coatings on the peds; columnar structure; very hard when dry, very firm when moist, sticky and plastic when wet; very strongly acid.
22 to 39 inches, light-gray coarse sandy clay loam with brown coatings on the peds; prismatic structure; very hard when dry, very firm when moist, sticky and plastic when wet; very strongly acid.
39 to 52 inches +, white coarse sandy clay loam; very hard when dry, extremely firm when moist, sticky and plastic when wet; very strongly acid.

The surface soil is dark grayish brown to yellowish brown. In places a thin capping of reddish-brown, gravelly, quartzitic material similar to that of the Red Bluff soils is on the surface. Depth to the clayey subsoil is generally 10 to 20 inches, but it is as much as 30 inches in the hummocks. An area near the Sacramento County line south of State Highway 16, has a surface soil of light yellowish-brown silt loam that grades to a subsoil of mottled yellow, yellowish-brown, and white silty clay. In some places iron-cemented layers that are 1-inch thick occur at a depth below 20 inches. In some places shot consisting of iron and manganese are near the surface, and prismatic concretions less than 2 inches in diameter and 7 inches in length are in the lower part of the subsoil. Also, this soil is infertile and strongly acid to very strongly acid.

This soil is moderately well drained. Permeability is moderately rapid in the surface soil. It is very slow in the subsoil, and in places the subsoil is impermeable. The available water holding capacity is low, root pene-

tration is shallow to moderately deep, and fertility is very low. Runoff is medium to rapid, and the erosion hazard is moderate to severe.

Included with this soil in mapping are some areas of a reddish-brown Red Bluff soil.

Mokelumne sandy loam, 2 to 5 percent slopes, is used for range. Yields of forage are low, and the quality of the forage is poor. Range plants respond if large amounts of fertilizer containing nitrogen and phosphate are applied, but the increase in yields probably would not warrant the cost. Adding lime would decrease acidity. Capability unit IVe–39(18); range site 4.

Mokelumne coarse sandy loam, 5 to 36 percent slopes (MsD).—This moderately sloping to moderately steep soil is on dissected terraces, mostly in the northwest corner of the Area. It formed in remnants of coarse-textured, granitic alluvium deposited over old sandstone and clayey marine sediments. The vegetation is mostly dense brush, thin to dense thickets of oaks, a few digger pines, and a sparse understory of grass (fig. 20).

Figure 20.—**Typical view of a recently cleared area of Mokelumne coarse sandy loam, 5 to 36 percent slopes, on which brush is encroaching.**

The surface soil is very dark gray to grayish-brown coarse sandy loam or loamy coarse sand. It is very strongly acid to strongly acid. The subsoil is very pale brown or yellowish-brown sandy clay loam, clay, or silty clay, and in places it is mottled with red stains from iron. It is very strongly acid to extremely acid, is very hard when dry, and has blocky or columnar structure. Depth to the clayey subsoil ranges from 15 to 25 inches. Gravel and an occasional stone are scattered throughout the profile. The sand in the profile consists mostly of subrounded grains of quartz. Generally, loosely consolidated sandstone underlies the subsoil. A small acreage has been mined. In some places the soil is strong brown or yellowish red.

This soil is well drained to somewhat excessively drained. Permeability is rapid in the surface soil and slow to very slow in the subsoil. The available water holding capacity is low. Fertility is very low. Runoff is rapid to very rapid, and the erosion hazard is severe to very severe.

This soil has limited value for grazing. Dense, brushy areas are used as watershed and for wildlife. Some cleared areas were seeded to mixtures of grasses and legumes, but the results were poor. Pasture plants on this soil respond if large amounts of nitrogen and phosphate are applied, but the increase in yields probably would not warrant the cost. Adding lime would decrease acidity, but no field trials have been made to determine the amount of lime needed. If this soil is cultivated, it is subject to severe erosion. Capability unit VIe–9(18); range site 4.

Mokelumne soils and Alluvial land (Mt).—This mapping unit consists of Mokelumne sandy loam, 2 to 5 percent slopes, and of Alluvial land in variable proportions. The Mokelumne sandy loam formed in material from old sandstone and clayey marine sediments. Alluvial land is made up of recent alluvium from these sediments and from sedimentary rock land. The Mokelumne soils and Alluvial land occur together in a complicated pattern. Generally, the Mokelumne soils are on lower foot slopes of dissected terraces and are hummocky in places, and Alluvial land is on stream terraces and flood plains. Slopes range from 0 to 9 percent. The vegetation is grass-oak.

Alluvial land in this unit consists mostly of well drained to moderately well drained, pale-brown to light-gray sandy loam. It is underlain by a substratum of sandy clay loam to sandy clay. Depth to the substratum is 15 to 25 inches. Alluvial land is commonly stratified with fine sandy loam to silty clay loam and in places contains quartz gravel. It is medium acid to strongly acid and is low in fertility.

Characteristics of the soils in this unit vary, but in general, drainage is good to moderately good. Permeability of the surface soil is moderately rapid, and that of the subsoil is slow to very slow. The available water holding capacity is moderate to low, root penetration is moderately deep to shallow, and fertility is very low. Runoff is slow to rapid, and the erosion hazard is moderate to severe. Areas near drainageways are subject to occasional flooding. Water remains on the surface during the rainy season, and the soil remains seasonally wet for long periods.

Included with this unit in mapping are some areas of Red Bluff gravelly loam and of Pentz sandy loam.

Mokelumne soils and Alluvial land is used mostly for grazing, mainly by cattle. A small acreage is planted to hay and grain or to improved pasture. Yields are generally low. Pasture plants on this soil respond well if large amounts of fertilizer containing nitrogen and phosphate are applied. Mokelumne sandy loam, 2 to 5 percent slopes, is in capability unit IVe–39(18); range site 4. Alluvial land is in capability unit IVw–2(18); range site 1.

Musick Series

The Musick series consists of well-drained, deep and moderately deep soils formed from granitic rock. These soils are gently sloping to very steep. They are in the eastern part of the Area on mountainous ridges and side

slopes at elevations from 2,000 to 5,000 feet. Conifers, hardwoods, brush, and grass make up the vegetation.

The surface soil is brown to reddish-brown sandy loam or loam. It is friable and medium acid. The subsoil, a red to yellowish-red clay loam or clay, is firm and medium acid to strongly acid. These soils are porous and micaceous. Depth to weathered bedrock ranges from 35 to more than 100 inches. From 15 to 25 percent of the surface of the very rocky soils consists of rock outcrops. In places from 40 to 60 percent of the surface of the extremely rocky soils consists of rock outcrops.

Musick soils are used mostly for timber. Some areas are grazed, and a small acreage is planted to hay and grain crops, to vineyards, and to orchards of apples and walnuts.

Musick very rocky sandy loam, 16 to 51 percent slopes (MvE).—This moderately steep to steep soil, the most extensive of the Musick series, is on slightly convex slopes and ridges. Most areas have been cleared, and the present cover consists mainly of grass and small conifers.

Representative profile under conifers, hardwoods, and brush:

0 to 14 inches, reddish-brown sandy loam; granular structure; soft when dry, friable when moist; medium acid.
14 to 23 inches, yellowish-red heavy loam; massive; slightly hard when dry, friable when moist, slightly plastic when wet; medium acid.
23 to 47 inches, red heavy clay loam; massive; hard when dry, firm when moist, plastic and sticky when wet; strongly acid.
47 to 74 inches, light-red sandy loam or coarse sandy loam; massive; slightly hard when dry, friable when moist, slightly sticky when wet; medium acid.
74 to 97 inches, reddish-yellow fine sandy loam with light red stains; massive; slightly hard when dry, friable when moist; strongly acid.
97 inches +, speckled white, reddish-yellow, and very dark gray weathered granodiorite; rock structure visible in place, but the material crumbles easily if disturbed.

From 2 to 4 inches of forest litter is on the surface in most places. The litter consists of pine needles, oak leaves, twigs, and in places, grass. It is partly decomposed in the lower part. The surface soil ranges from brown to reddish brown and from light loam to sandy loam. The subsoil ranges from red to yellowish red and from clay loam to clay. Weathered bedrock is at a depth between 50 and 100 inches.

In places rock outcrops cover from 15 to 25 percent of the surface. In some places the soil is grayish-brown coarse sandy loam and is on narrow ridges capped with volcanic conglomerate. In other places are cobbly dark-brown loams that have a subsoil of yellowish red to brown.

This soil is well drained. Permeability of the surface soil is moderate, and that of the subsoil is moderately slow. The available water holding capacity is high to very high, root penetration is very deep, and fertility is moderate. Runoff is medium to very rapid, and the erosion hazard is very severe.

Strong slopes, rocks, and unfavorable climate limit the use of this soil for crops. The soil is therefore used mostly for timber and some grazing. If this soil is well managed, rapid-growing stands of high-quality timber are produced. The soil is subject to severe erosion if the cover is destroyed by fire or removed by other means. Logging must be carefully done on the steep slopes. Capability unit VIs–1(22); woodland suitability group 4.

Musick sandy loam, 3 to 9 percent slopes (MuB).—Areas of this gently sloping soil are on foot slopes or smooth, rounded ridges. The areas are small and adjoin steeper areas that generally are rocky and forested. This soil is fairly free of rock outcrops. Small areas in swales are affected by seepage or runoff water. In these places the surface soil is dark colored and the vegetation is commonly sedges and wiregrass. Runoff is slow, and the erosion hazard is moderate.

This soil is used mostly for timber. Some cleared areas are used for grazing or are cropped to hay or grain. A small acreage is planted to orchards of walnuts and apples for use on the farm. Yields are fair to poor, depending upon management and whether or not frosts occur. Crops on this soil respond if fertilizer that contains nitrogen and phosphate is applied, and if sulfur is added occasionally. Capability unit IIIe–1(22); woodland suitability group 2.

Musick sandy loam, 9 to 16 percent slopes (MuC).—This soil is on hills and ridges. Except that it is less sloping than Musick very rocky sandy loam, 16 to 51 percent slopes, and is fairly free of rock outcrops, it is otherwise similar to that soil. Runoff is slow to medium, and the erosion hazard is moderate to severe.

In general, unfavorable climate restricts the crops that can be grown on this soil. This soil is therefore used mostly for timber. A small acreage has been cleared and used for grazing or for hay and grain.

If this soil is cultivated, farming across the slope, stripcropping, contour plowing, and other practices can be used to help control erosion. Also, leaving trees, grass, or other permanent cover on the soil helps prevent erosion. Capability unit IVe–1(22); woodland suitability group 2.

Musick sandy loam, 16 to 31 percent slopes (MuD).—Areas of this moderately steep soil are on side slopes. Because of erosion, the surface soil is thin in some places. It ranges from 8 to 18 inches in thickness. The subsoil ranges from sandy clay loam to clay loam. This soil is fairly free of rocks. There are only a few rock outcrops on the surface. Runoff is medium to rapid, and the erosion hazard is severe to very severe.

This soil is too steep for cultivation. It is therefore used mostly for timber and some grazing. The soil is well suited to trees of good quality, and they grow rapidly on it. Capability unit VIs–1(22); woodland suitability group 4.

Musick sandy loam, 31 to 51 percent slopes (MuE).—This steep soil is on side slopes and sharply sloping ridge crests. The profile is similar to that of Musick very rocky sandy loam, 16 to 51 percent slopes, but this soil has only a few rock outcrops on the surface. Runoff is rapid to very rapid, and the erosion hazard is very severe.

This soil is used for timber and for some summer grazing. If logging is done, special practices that prevent erosion are needed in places. Cutting the trees selectively, placing the slash in gullies, locating landings for loading so that a minimum number of skid trails are required, and providing turnouts to carry runoff water away from logging roads are suitable practices. This soil is productive of timber if it is well managed. Capability unit VIs–1(22); woodland suitability group 4.

Musick very rocky sandy loam, 9 to 16 percent slopes (MvC).—This soil is in rolling, hilly areas. In places from 15 to 25 percent of the surface is covered by outcrops of granitic rock. Runoff is slow to medium, and the erosion hazard is moderate to severe.

In general, the use of this soil for crops is limited because it is too rocky for cultivation and the climate is unfavorable. Therefore, this soil is used mostly for timber. Some cleared areas are used for grazing. Capability unit Vs–7(22); woodland suitability group 2.

Musick very rocky sandy loam, 51 to 71 percent slopes (MvF).—This soil is on sharp breaks that drop to river canyons, mainly near the Mokelumne River in the southeastern part of the Area. In places the profile is more brown than the profile described as representative of the series and the soil is similar to the Holland soils. On walls of the canyons, large boulders of rock jut out, but the number of rock outcrops on the soil is fairly variable. Generally, this soil is moderately deep over bedrock and the rock is less weathered than in shallower Musick soils. Depth to bedrock ranges from 35 to 50 inches. Runoff is very rapid, and the erosion hazard is very severe.

The use of this soil for agriculture is fairly limited. In some places timber of good quality is produced. Mature trees can be harvested with care, but this soil is difficult to manage, and special logging practices are needed in harvesting. Areas under a cover of timber and brush should be protected from fire and maintained as protected watershed or as wildlife or recreational areas. Capability unit VIIs–1(22); woodland suitability group 4.

Musick very rocky sandy loam, moderately deep, 16 to 51 percent slopes (MwE).—Areas of this moderately steep to steep soil are on ridge crests, saddles, and side slopes. The main acreage is on a large isolated body of granitic rock between Pine Grove and Jackson at elevations of 2,000 to 2,500 feet. This granitic intrusion is surrounded by slate and schist. In places the soil formed partly in material from contact metamorphosed micaceous schist, as well as from acid igneous rock. The vegetation is largely brush and oak and a few scattered conifers. There are also some open areas.

The surface soil is dark-brown to reddish-brown sandy loam to loam. It is slightly acid to medium acid and 8 to 15 inches thick. The subsoil, a red to dark-red sandy clay loam or clay loam, is strongly acid and 15 to 30 inches thick. On very rocky ridge crests, the soil is less than 10 inches deep in places. Depth to bedrock ranges from 35 to 45 inches. Rock outcrops are common.

The water-holding capacity of this soil is moderate, and root penetration is moderately deep to deep. Runoff is rapid to very rapid, and the erosion hazard is very severe.

A small acreage near the place where granitic rock comes in contact with slate and schist consists of Josephine very rocky loam or of Sites very rocky loam. Also included is a small area of a soil that is grayish brown and has a surface layer of coarse sandy loam.

Much of Musick very rocky sandy loam, moderately deep, 16 to 51 percent slopes, is cut over and used mostly for grazing. Minor stands of conifers are used for lumber. A small acreage is dry-farmed to vineyards and walnuts. The vineyards and walnut orchards are largely abandoned because of erosion and low yields. Areas used for cropland are moderately eroded and in some places contain rills and gullies. Adequate vegetation should be left on this soil, especially during the rainy period. Capability unit VIs–81(22); woodland suitability group 8.

Musick very rocky sandy loam, moderately deep, 51 to 71 percent slopes (MwF).—This very steep soil is on sharp breaks that drop to river canyons. It is in the eastern part of the survey Area at elevations of about 4,000 feet. Depth to bedrock is highly variable, but it generally ranges from 35 to 45 inches. The vegetation is mostly ponderosa pine, sugar pine, cedar, Douglas-fir, and red fir. It includes some black oaks and areas of manzanita, whitethorn, and other kinds of brush. Runoff is very rapid, and the erosion hazard is very severe.

Mapped with this soil are some areas of Cohasset very cobbly loam or of Windy cobbly sandy loam. Also included are some areas of cobbly soil on narrow ridges capped with volcanic conglomerate.

Musick very rocky sandy loam, moderately deep, 51 to 71 percent slopes, has limited use for agriculture. Stands of conifers suitable for lumber or poles are on most areas, but they can be harvested only with difficulty. The soil is best suited to use as protected watershed, for wildlife, or as recreational areas. Capability unit VIIs–81(22); woodland suitability group 8.

Musick extremely rocky sandy loam, moderately deep, 51 to 71 percent slopes (MxF).—On this very steep soil, rock outcrops occupy from 40 to 60 percent of the surface in places. Much of the cover consists of dense stands of brush and of scattered conifers and hardwoods. Runoff is very rapid, and the erosion hazard is very severe.

This soil is used mostly as protected watershed and as browse areas for wildlife. In a few places where roads are accessible, trees are cut for lumber or firewood. Capability unit VIIs–81(22); woodland suitability group 8.

Pardee Series

In the Pardee series are well-drained, shallow, cobbly or gravelly soils formed in old mixed alluvium. The alluvium consists of old outwash and of material resulting from erosion of the Sierra mountain range. It thinly mantles rhyolitic tuff, andesitic conglomerate, sandstone, clay, and other geologic formations. Pardee soils are undulating to hilly. They are on terraces in widely scattered areas on lower foothills in the western part of the Area. The vegetation is mainly grass-oak, but it includes some digger pines and brush.

The surface soil, a brown or reddish-brown gravelly or cobbly loam, is medium acid. The subsoil is brown, reddish-brown, or red gravelly or cobbly clay loam or clay that also is medium acid. The thickness of the solum ranges from 12 to 24 inches. Waterworn, rounded rock fragments in the soil are high in quartz and quartzite, and these and other kinds of rock make up as much as 60 percent of the soil mass, by volume, in places.

Pardee soils are used chiefly for grazing. They are too cobbly and shallow for crops.

Pardee cobbly loam, 3 to 31 percent slopes (PaD).—This is the only soil of the Pardee series mapped in the Area. It is undulating to hilly and is on terraces.

Representative profile under grass and over andesitic conglomerate:

0 to 9 inches, brown gravelly loam; massive; hard when dry; slightly acid.
9 to 17 inches, brown gravelly clay loam; slightly sticky and plastic when wet; medium acid.
17 to 18 inches, brown to reddish-brown cobbly clay; sticky and very plastic when wet; strongly acid; 1 to 7 inches thick.
18 to 41 inches +, very pale brown to brownish-yellow and gray, consolidated, andesitic tuff; very hard when dry; no roots or pores; medium acid.

This soil is predominantly shallow over bedrock, but in places there are pockets where the soil is deeper. Rock fragments in the profile vary, but they generally increase in size and number with increasing depth (fig. 21). The surface soil ranges from brown to reddish brown, and generally, the subsoil is redder than the surface soil. In some places there are fragments of lateritic iron washed from nearby areas of Sedimentary rock land. In most places the texture of the surface soil is loam, but it may be sandy loam, especially in very gravelly areas or in

Figure 21.—**Profile of Pardee cobbly loam, 3 to 31 percent slopes; the tape indicates a depth of more than 1 foot.**

areas underlain by rhyolitic tuff. The texture of the subsoil is generally sandy clay loam or clay loam. In the lower part of the subsoil the texture is clay in places, partly because of weathering of the substratum or rock in place.

In places as much as 15 percent of the soil consists of brownish-gray or pale-brown sandy loam. In these places the soil is 8 to 24 inches thick over bedrock and the subsoil is very strongly acid.

Pardee cobbly loam, 3 to 31 percent slopes, is well drained. The available water holding capacity is low, root penetration is shallow, and fertility is low. Runoff is slow to rapid, and the erosion hazard is moderate to severe.

This soil is used almost solely for grazing. Yields are mostly low. Forage plants on this soil respond if fertilizer that contains nitrogen and phosphate is applied. Capability unit VIe–9(18); range site 4.

Pentz Series

The Pentz series consists of well-drained, very shallow to shallow, deep sandy loams formed in material from moderately consolidated rhyolitic tuff. These soils are gently sloping to moderately steep. They are on foothills at elevations from 200 to 500 feet in the southwest corner of the Area, where they extend from the Mokelumne River to the Sacramento County line. The vegetation is predominately grass-oak, but it includes some dense brushy areas and a few scattered digger pines.

The surface soil is light brownish-gray to pale-brown sandy loam that is slightly acid to medium acid. It is porous and is friable when moist and slightly hard when dry. The subsoil, a light brownish-gray sandy loam, is strongly acid. These soils are predominately shallow to very shallow. They range from 8 to 24 inches in depth and overlie very pale brown to light-gray rhyolitic tuff. The tuff is extremely hard when dry, has the appearance of sandstone in place, and in some places weathers to clay.

Except for some areas that are mantled with unrelated gravelly and cobbly alluvium, Pentz soils are nearly free of rock. Occasional outcroppings of tuff occur in the very shallow Pentz soils. The Pentz soils are subject to erosion if they are cultivated or if they are left without a cover of vegetation.

These soils are used for grazing livestock, principally cattle. During years when rainfall is well distributed, fair stands of grasses and filaree are produced on these soils, but there is generally no burclover. Except for the moderately deep soils, the available water holding capacity is low and the soils are droughty. Areas planted to dry-farmed orchards have been abandoned because of poor yields. A small acreage is occasionally planted to hay or grain.

Pentz sandy loam, 2 to 16 percent slopes (PnC).—This undulating to rolling soil, the most extensive of the Pentz series, has slopes that are predominately less than 9 percent.

Representative profile under grass:

0 to 10 inches, light brownish-gray sandy loam; massive; slightly hard when dry, friable when moist; many very fine pores; slightly acid to medium acid.

10 to 19 inches, light brownish-gray sandy loam; massive; slightly hard when dry, friable when moist; porous; discontinuous hard lens, 1 to 3 inches thick, near the upper boundary; strongly acid.

19 inches +, very pale brown to light-gray, hard, rhyolitic tuff, with silica coatings on the upper surface; a few fine roots, mostly along cleavage planes, but none below a depth of 28 inches; strongly acid.

The surface soil ranges from sandy loam to fine sandy loam in texture, and from light brownish gray to pale brown in color. Depth to bedrock ranges from 8 to 24 inches. The gently sloping areas are somewhat hummocky in places. In swales the surface soil has slight mottlings caused by runoff water and seepage from side slopes. Some areas of this soil are overlain by a thin capping of gravelly or cobbly, reddish soil material similar to that of the Red Bluff soils.

This soil is well drained to somewhat excessively drained. Permeability is moderately rapid. The available water

holding capacity is low, root penetration is shallow, and fertility is low. Runoff is slow to rapid, and the erosion hazard is slight to severe.

Most of this soil is used as range for cattle. Yields of forage are generally low except in years when rainfall is adequate and favorably spaced. Forage plants respond well if fertilizer that contains nitrogen and phosphate is applied, but the increase in yields may not warrant the cost. Small areas are periodically planted to hay. If range on this soil is overgrazed, yields of forage are reduced greatly and the range is slow to recover. Capability unit VIs–49(18); range site 6.

Pentz sandy loam, 9 to 16 percent slopes, eroded (PnC2).—This gently sloping to strongly sloping soil is on hills. Except that it has been cropped in the past and is now eroded, this soil is similar to Pentz sandy loam, 2 to 16 percent slopes. The surface soil is very thin and in some places lacking. Depth to weathered bedrock ranges between 9 and 14 inches.

This soil is well drained to somewhat excessively drained. Permeability is rapid in the surface soil and moderately rapid in the subsoil. Root penetration is shallow, and the available water holding capacity is low. Runoff is medium to rapid. The erosion hazard is moderate to severe.

Included with this soil in mapping is a small area of Pardee cobbly loam, 3 to 31 percent slopes.

Much of Pentz sandy loam, 9 to 16 percent slopes, eroded, is no longer cultivated and has reverted to range. The range consists of annual grasses and forbs of poor quality. Yields are low. Grazing should be deferred until the more palatable and better producing grasses can be reestablished. Capability unit VIs–49(18); range site 6.

Pentz sandy loam, 16 to 31 percent slopes (Pnd).—This steep soil is on side slopes of tabular ridges. Depth of the soil is variable because of downhill creep on steep slopes. On foot slopes, depth to bedrock ranges between 16 and 30 inches and decreases as the slope ascends. Near the crest of the ridges, the depth is less than 10 inches in places. In some places the soil is capped with reddish, gravelly soil material similar to that in the Perkins or Red Bluff soils. Runoff is very rapid, and the erosion hazard is very severe.

Included with this soil in mapping is a shallow Pardee cobbly gravelly loam, 3 to 31 percent slopes. Also included are some areas of Inks loam and Rock land, 3 to 45 percent slopes.

Pentz sandy loam, 16 to 31 percent slopes, is used almost exclusively for range because of steep slopes and the nearness of bedrock to the surface. Forage on this soil becomes green early with the first winter rains and matures quickly. Yields are generally low. Capability unit VIs–49(18); range site 6.

Pentz gravelly sandy loam, 2 to 16 percent slopes (PpC).—This gently sloping to strongly sloping soil is on hills and ridges. Because remnants of old consolidated gravelly alluvium cap the areas, the color in much of this soil is reddish brown to brown and the texture is gravelly or cobbly. The gravel content ranges from 15 to 20 percent, by volume, in places. Most of the gravel is in the surface layer and is less abundant with increasing depth. The texture of the surface layer is slightly finer than in the other Pentz soils and approaches fine sandy loam. The subsoil is brown to yellowish red. Depth to hard tuff ranges from 13 to 20 inches. Runoff is medium to rapid, and the erosion hazard is moderate to severe.

Included with this soil in mapping are areas of Pardee cobbly loam. This included soil makes up about 15 percent of this mapping unit in places.

Pentz gravelly sandy loam, 2 to 16 percent slopes, is used for range. The forage grown is about the same as that grown on Pentz sandy loam, 2 to 16 percent slopes, and yields are about the same. Capability unit VIs–49 (18); range site 6.

Pentz sandy loam, very shallow, 2 to 51 percent slopes (PoE).—This soil is on tabular ridges and in areas where the soil mantle is very thin and outcrops of tuff are exposed. Depth to bedrock ranges from 4 to 12 inches. The surface soil is light brownish gray to pale brown. It is massive, slightly acid, and 2 to 6 inches thick. The subsoil is brown to light brownish gray, medium acid to strongly acid, and 3 to 8 inches thick. In places there are outcroppings of tuff.

Drainage is somewhat excessive in this soil. Permeability is rapid throughout. The available water holding capacity is very low, root penetration is very shallow, and natural fertility is low. Runoff is medium to very rapid, and the erosion hazard is moderate to very severe.

This soil is used solely for grazing. Yields are low, and grasses and forbs dry up quickly with the first warm spell in spring. Capability unit VIIs–4(18); range site 8.

Perkins Series

In the Perkins series are well-drained, brown to reddish-brown soils formed in old consolidated gravelly alluvium. These soils are gently sloping to hilly. They are on dissected terraces in the western part of the Area, mainly at elevations of 200 to 500 feet. The vegetation is mostly grass-oak.

The surface soil, a brown or reddish-brown loam, is medium acid and is gravelly in places. The subsoil is reddish-brown or red gravelly clay loam or clay and is also medium acid. The gravel consists mostly of quartz or quartzite, but it includes small amounts of fragmental slate, schist, and basic rock. In some areas cobblestones as much as 6 inches in diameter are common. Depth to cemented gravel or unconforming bedrock is dominantly 24 to 50 inches, but it is deeper in places.

Perkins soils are used mostly for grazing. A small acreage of the deep soils is used for dryland grain, hay, milo, irrigated pasture, or vineyards.

Perkins loam, 0 to 3 percent slopes (PrA).—This nearly level soil is on slightly elevated terraces. It is in the western part of the Area, on the fringe of Jackson and Ione Valleys.

Representative profile in area under grass that formerly was cultivated:

0 to 8 inches, brown loam; massive, but breaks to granular structure; slightly hard when dry, friable when moist, slightly plastic when wet; medium acid.
8 to 23 inches, reddish-brown gravelly loam that is mottled in places; massive; slightly hard when dry, friable when moist, and slightly plastic when wet; medium acid.
23 to 40 inches, red gravelly clay loam that is finely mottled; massive; hard when dry, slightly firm when moist, slightly sticky and slightly plastic when wet; medium acid.
40 inches +, cemented gravelly sandstone.

The surface soil contains 2 to 15 percent of gravel, by volume, in some places. The amount of gravel in the profile generally increases with increasing depth. In some places the soil contains fragments of lateritic iron washed from nearby areas of Sedimentary rock land. In these places the color of the soil is a more intense red than that of the representative profile described. The texture of the surface soil is mostly loam, but it is sandy loam in very gravelly areas. The subsoil ranges from sandy clay loam to clay loam or clay and contains as much as 15 to 25 percent of gravel, by volume.

This soil is well drained. Permeability of the surface soil is moderate, and that of the subsoil moderately slow to slow. The available water holding capacity is moderate to high, root penetration is moderately deep to deep, and fertility is moderate to low. Runoff is slow, and the erosion hazard is slight.

Mapped with this soil are areas of very deep, very fine sandy loam. These areas adjoin valley bottoms. Also included are areas of Red Bluff-Mokelumne complex on higher terraces.

Perkins loam, 0 to 3 percent slopes, is used for grazing, for dryland crops, or for irrigated pasture. Among the dry-farmed crops are barley, oats, milo, and grapes. Yields are fair, depending upon rainfall and management. Crops on this soil respond if fertilizer that contains nitrogen and phosphate is added. Capability unit IIIs–3(18); range site 1.

Perkins loam, 3 to 16 percent slopes (PrC).—Areas of this soil are undulating to rolling and are on terraces above alluvial valley bottoms. This soil has stronger slopes, but it is otherwise similar to Perkins loam, 0 to 3 percent slopes. Runoff is slow to medium, and the erosion hazard is moderate.

Small areas of Red Bluff-Mokelumne complex are mapped with this soil. These included soils are generally moderately deep and are on knolls.

Perkins loam, 3 to 16 percent slopes, is used mostly for grazing. A small acreage is planted to grain and hay. There are also a few small vineyards, which are not intensively managed. Capability unit IIIe–3(18); range site 1.

Peters Series

The Peters series consists of dark-gray, strongly acid clayey soils formed in material weathered from volcanic tuff. These soils are well drained, moderately deep, and gently sloping to moderately sloping. They are in swales and in small pockets in the southwest corner of the Area. The vegetation consists of grasses and weeds.

The surface soil is dark grayish-brown to dark-gray clay that is plastic and strongly acid. It is massive when moist, but it generally cracks when dry. The subsoil is very dark gray and is splotched with pale yellow; it is pale olive or yellow with increasing depth. The reaction of the subsoil is neutral. Depth to weathered tuff ranges from 24 to 36 inches. A few fine roots penetrate to depths of 30 inches.

Peters soils are not extensive. They occupy small areas used mostly for grazing.

Peters clay, 3 to 9 percent slopes (PtB).—This is the only soil of the Peters series mapped in the Area. It occupies swales and small valley bottoms.

Representative profile under grass:

0 to 3 inches, dark grayish-brown clay mixed with organic matter; granular structure; slightly hard when dry; strongly acid.

3 to 21 inches, very dark gray clay; massive to blocky structure; very hard when dry, firm when moist, very sticky and very plastic when wet; strongly acid to medium acid.

21 to 32 inches, very dark gray clay; many splotches of pale yellow; massive to blocky structure; hard when dry, firm when moist, very sticky and very plastic when wet; a few fine roots; slightly acid.

32 to 36 inches, variegated pale-yellow and very dark grayish brown clay; massive; extremely hard when dry, firm when moist, very sticky and very plastic when wet; no roots; neutral.

36 to 43 inches +, pale-yellow, weathered andesitic tuff that crushes to clay when moist.

The surface soil has a thin mantle of reddish-brown gravelly material in some places. The soil is seasonally wet throughout for long periods.

This soil is well drained. Permeability is slow. The available water holding capacity is moderate, root penetration is moderately deep, and fertility is moderate. Runoff is slow to medium, and the erosion hazard is none to slight.

Peters clay, 3 to 9 percent slopes, is used solely for range, and weedy annuals are the dominant vegetation. Yields of forage are low. Capability unit IVe–3(18); range site 4.

Placer Diggings and Riverwash (Pw)

This miscellaneous land type consists of stony, cobbly, and gravelly material, commonly found in beds of streams or creeks, or of areas that have been placer mined and that contain enough fine sand or silt to support some grass for grazing. The material that makes up this land type is derived from a mixture of rocks and is commonly stratified or poorly sorted. In some steep areas the material consists of fines from stamp mills or of tailings from placer mining. The depth of the soil material is fairly variable. It ranges from 6 inches to more than 5 feet. Areas in streambeds are frequently flooded during the rainy season. Drainage varies.

The vegetation varies, but it generally consists of grass, browse, oak, and a few conifers. Alder, willow, cottonwood, or maple are generally along the edge of areas adjacent to streams.

This land type has some value for grazing and provides watering places for livestock. Capability units VIIs–0(18 and 22); range site 10.

Red Bluff Series

The Red Bluff soils are well-drained, reddish-brown gravelly loams that are in the western part of the Area on dissected terraces of lower foothills. Generally, the Red Bluff soils are on the crests of hills and the upper part of slopes. The associated Mokelumne soils are on the gentler, concave slopes. Red Bluff soils formed in old gravelly alluvium washed from the Sierras and deposited in old outwash plains over older sandstone and clayey marine sediments.

The surface soil is reddish-brown to yellowish-red gravelly loam (fig. 22) that is friable and slightly acid to medium acid. The gravel is of mixed origin but is high in quartz or quartzite. The subsoil, a red to dark-red

Figure 22.—**Road cut in a gravelly Red Bluff soil.**

gravelly clay or clay loam commonly stained with yellowish mottles, is very strongly acid to extremely acid. Depth to consolidated sandstone or clayey sediments ranges from 10 to more than 48 inches.

Red Bluff-Mokelumne complex, 5 to 16 percent slopes (RbD).—This unit is moderately sloping to strongly sloping and is on terraces. In many places a Red Bluff soil grades to a Mokelumne soil and there is no sharp boundary between them. About 60 percent of this mapping unit consists of Red Bluff gravelly loam, 25 percent of Mokelumne gravelly sandy loam, and the rest of other soils, such as Perkins, Pentz, Mokelumne, and alluvial land and Sedimentary rock land.

Representative profile of the dominant Red Bluff member under grass-oak:

0 to 7 inches, reddish-brown gravelly loam that is almost a gravelly fine sandy loam; massive; hard when dry, friable when moist; slightly acid.
7 to 11 inches, yellowish-red loam or clay loam; massive; hard when dry, friable when moist, slightly sticky and slightly plastic when wet; very stongly acid.
11 to 27 inches, red gravelly clay with streaks of pale brown; massive; very hard when dry, very firm when moist, sticky and plastic when wet; extremely acid.
27 to 40 inches, pale-brown, consolidated gravelly clay with dark-red coatings; massive; very hard when dry, extremely firm when moist, sticky and plastic when wet; extremely acid.

Depth to consolidated clay and sandstone ranges from 10 to 36 inches. The color of the surface soil ranges from light yellowish brown to dark reddish brown. Where the cover of gravel on the surface is abundant, the soil generally has a texture of gravelly sandy loam and the color of the subsoil is strong brown to red. Where the cover of gravel is thin, the subsoil is generally loam.

The soils in this complex are well drained to moderately well drained. Permeability of the surface soil is moderate, and that of the subsoil is slow to very slow. The available water holding capacity is moderate, root penetration is moderately deep, and fertility is very low. Runoff is medium to rapid, and the erosion hazard is moderate to severe.

This complex is used mostly for grazing. The forage is primarily filaree, soft chess, and weedy annuals. A small acreage has been planted to hay and grain. Yields of forage and crops are low. Forage and cereal plants respond if fertilizer that contains nitrogen and phosphate is added, but the increase in yields probably would not warrant the cost. Little information is available on the value of applying lime. The soils in this complex are difficult to work because of gravel and because of the dissected terrain. Capability unit IVe–39(18); range site 4.

Red Bluff-Mokelumne complex, 0 to 5 percent slopes (RbB).—The soils in this complex are nearly level to gently sloping. They are in swales and on foot slopes of low terraces. The surface is commonly irregular; it has high hummocks surrounded by wet, small drainageways.

About 50 percent of this mapping unit consists of Red Bluff gravelly loam, about 35 percent of Mokelumne gravelly sandy loam, and the rest of other soils. In the Red Bluff member, the surface soil is generally reddish brown, and the subsoil is red gravelly clay. The Red Bluff soil is commonly mottled throughout. Depth to sandstone or clayey marine sediments is 24 to more than 48 inches. In the Mokelumne member, the surface soil is commonly light brownish-gray, very pale brown, or reddish-brown gravelly sandy loam. The subsoil is pale-brown to reddish-brown sandy clay loam or clay.

In swales the soils in this complex are moderately well drained, but on higher terraces or hummocks they are well drained. The soils in this complex are very low in fertility and are extremely acid in the lower part. Runoff is medium, and the erosion hazard is none to slight.

This complex is used mostly for grazing, and yields are poor. Some areas are planted to hay and grain; yields are limited. Capability unit IVe–39(18); range site 4.

Red Bluff-Mokelumne complex, 16 to 36 percent slopes, eroded (RbE2).—This mapping unit consists of Red Bluff gravelly loam, 16 to 36 percent slopes, eroded, and of Mokelumne gravelly sandy loam, 16 to 36 percent slopes, eroded. Areas of this complex are on hilly, dissected terraces. The Red Bluff soil generally ranges in depth from 10 to 20 inches. Its subsoil, a reddish-brown gravelly clay loam, is less red and less clayey than that of Red Bluff soils in flatter more nearly level areas. The Mokelumne member in this complex is less extensive than in areas where slopes are gentle.

The soils in this complex are moderately eroded to severely eroded. In some places rills and gullies are evident, especially in the Mokelumne soil. Runoff is rapid to very rapid, and the erosion hazard is severe to very severe.

This complex is used for range. Yields are low. Capability unit VIe–9(18); range site 4.

Red Bluff-Mokelumne-Mine pits complex, 2 to 16 percent slopes (RmD).—This mapping unit consists of Red Bluff gravelly loam, 2 to 16 percent slopes, of Mokelumne gravelly sandy loam, 2 to 16 percent slopes, and of Mine pits. It is on gently rolling and rolling terraces that have been placer mined for gold or scraped to expose deposits of clay. Shallow excavations were made and the soil material left in irregular mounds. Some small areas were relatively undisturbed. In areas where the

extremely acid clay or sandstone were exposed, the vegetation is sparse. Undisturbed areas and areas that contain mounds have vegetation similar to that growing on Red Bluff, Mokelumne, and other soils that make up the complex. Runoff is medium to rapid, and the erosion hazard is moderate to severe.

This complex is used mostly for range. Clay and sand is mined from some areas. The Red Bluff gravelly loam and the Mokelumne gravelly sandy loam are in capability unit IVe–39(18); range site 4. Mine pits are in capability unit VIIIs–8(18).

Rock Land (Ro)

This miscellaneous land type occurs throughout the Area. The terrain is rough and broken. The areas have numerous rock outcrops or are very shallow to rock. Within these areas are small areas where the soil is deeper to bedrock. The outcrops consist of granitic rock, metabasic rock, volcanic flow material, metasedimentary rock, and other rock. Slopes range from nearly level, on flat tabular ridges, to very steep, on walls of V-shaped canyons. The vegetation varies with elevation. The mountainous areas generally are barren or have scrubby conifers and brush on them. In the foothills the areas commonly have a cover of brush and sparse grass or are barren. Runoff is very rapid on all areas.

Rock land has little value for agriculture other than to provide limited grazing for livestock and wildlife or to serve as protected watershed. Capability units VIIIs–8(18) and VIIIs–8(22).

Ryer Series

The Ryer series consists of well-drained, very deep, yellowish-brown soils that have an extremely hard and dense subsoil. These soils formed in mixed, but dominantly basic, alluvium. Ryer soils are nearly level. They are on terraces and flood plains in the northwest corner of the Area near Carbondale. The vegetation is mostly grass, but it includes a few scattered oaks.

The surface soil is yellowish-brown light silty clay loam variegated with pale brown. It is massive, hard when dry, and medium acid. The subsoil, a light yellowish-brown and brown to reddish-brown heavy silty clay loam, is medium acid but becomes neutral to mildly alkaline with increasing depth. It has prismatic or blocky structure and is compact and extremely hard when dry. Generally, these soils are more than 60 inches deep. In some places quartz and mixed gravel are in the profile, mainly in areas where drainageways enter broad, nearly level flood plains.

Ryer soils are used mostly for grazing. A small acreage is planted to dry-farmed hay and grain. Most areas are undeveloped because irrigation water is lacking.

Ryer silty clay loam, 0 to 3 percent slopes (RyA).—This is the only soil of the Ryer series mapped in the Area. It is nearly level and on terraces and flood plains. The soil material was deposited largely by water from drainageways of Laguna Creek. The surface is slightly hummocky and is interlaced with shallow drainage swales and one or more deep creek channels.

Representative profile under grass:

0 to 13 inches, variegated light yellowish-brown and strong-brown light silty clay loam; massive; hard when dry, friable when moist, slightly sticky and slightly plastic when wet; medium acid.

13 to 18 inches, light yellowish-brown silty clay loam; massive but breaks to blocky structure; very hard when dry, firm when moist, sticky and plastic when wet; medium acid.

18 to 39 inches, brown to reddish-brown heavy silty clay loam; prismatic to blocky structure; extremely hard when dry, firm when moist, plastic and slightly sticky when wet; neutral to mildly alkaline.

39 to 56 inches +, light yellowish-brown silty clay loam with coatings of brown; massive to weak prismatic structure; very hard when dry, firm when moist, plastic and slightly sticky when wet; neutral to mildy alkaline.

The surface soil ranges from light yellowish brown to reddish brown in places and is commonly variegated. Its texture ranges from silty clay loam to loam. The subsoil has only a slight increase in clay, but it is very compact and dense. In some places, generally near adjoining higher terraces, the soil is a reddish-brown gravelly loam.

This soil is well drained. Permeability of the surface soil is moderate, and that of the subsoil is slow to very slow. The available water holding capacity is moderate, root penetration is moderately deep, and fertility is moderate to low. Runoff is slow, and the erosion hazard is none to slight.

Although this soil is used mostly for grazing, a small acreage is periodically planted to hay and grain. Crops and forage plants on this soil respond if fertilizer that contains nitrogen and phosphate is applied. Most areas are unimproved because irrigation water is lacking. If irrigation water were available, this soil would be well suited to shallow-rooted crops or to irrigated pasture. Capability unit IIIs–3(18); range site 1.

Sedimentary Rock Land (Sa)

This miscellaneous land type consists of areas of exposed sandstone and of clayey marine sediments that in places have a thin mantle of gravelly, pale-brown to reddish-brown soil material on them. The soil material contains numerous quartz pebbles and fragments of lateritic iron.

This land type is rolling to steep. It is on eroded terraces in the western part of the Area. The areas extend from the Mokelumne River northwestward, past Buena Vista and Ione, to the Sacramento County line. The vegetation is mostly a dense cover of brush, but it includes some oaks and digger pines and a sparse understory of grass. Also on this land type is a low-growing species of manzanita (*Arctostaphylos myrtifolia*).

In some places where the gravelly cap on the terrace is in moderately deep pockets, the soil material consists of reddish-brown gravelly loam. Alluvial soils are in swales and drainageways.

Sedimentary rock land is extremely acid and very low in fertility. It has little value for agriculture except as protected watershed or as wildlife areas. Clay and silica sand are mined commercially from large areas of this unit for use in manufacturing ceramic articles and glass. Deposits of soft coal are mined for the manufacture of wax and other products. Capability unit VIIIs–8(18).

Serpentine Rock Land (Sb)

In this miscellaneous land type are extremely rocky, broken areas of serpentine rock that have a very thin mantle of gravelly soil material on them. Rock outcrops occupy from 50 to 90 percent of the surface.

This land type is rolling to steep. The areas are mostly on slopes and ridges in the western part of the Area.

They are at elevations of 600 to 1,000 feet in a narrow belt that extends from the Mokelumne River northward to the El Dorado County line. The vegetation consists of dense stands of brush, of scattered oaks and digger pines, and of a sparse understory of grass.

In places small parts of this unit consist of very rocky silt loam near areas of basic rock or of very rocky loams near areas of metasedimentary rock.

Serpentine rock land has little value for agriculture except for limited grazing, as protected watershed, or areas for wildlife. In some areas there are deposits of chrome that have been worked intermittently. Capability unit VIIIs-8(18).

Shaver Series

The Shaver series consists of well-drained to somewhat excessively drained, deep to moderately deep, brown soils formed in material weathered from granitic rock. These soils are very steep. They are on mountainous canyon slopes at elevations of 2,000 to 5,000 feet. The vegetation is conifers, hardwoods, brush, and grass.

The surface soil, a brown coarse sandy loam, is friable and medium acid. The subsoil is similar in color, texture, and reaction but is more yellowish brown with increasing depth. Depth to weathered granitic rock ranges from 25 to more than 60 inches in most places. Rock outcrops generally occupy from 15 to 25 percent of the surface.

Shaver soils are used mostly for timber and for light grazing.

Shaver very rocky coarse sandy loam, 51 to 71 percent slopes (ScF).—This very steep soil, the most extensive of the Shaver series, is on canyon slopes adjacent to major rivers and streams.

Representative profile under conifers, hardwoods, and grass:

0 to 48 inches, brown coarse sandy loam; massive; soft to slightly hard when dry, friable when moist; very porous; medium acid.
48 to 65 inches +, yellowish-brown coarse sandy loam; massive; hard when dry, friable when moist; porous; medium acid.

The surface soil ranges from brown to dark grayish-brown in color and from coarse sandy loam to sandy loam in texture. The subsoil is yellowish brown to pale brown. It ranges from coarse sandy loam to loamy coarse sand in texture. Depth to decomposed granitic rock ranges from 35 to more than 60 inches. Rock outcrops occupy from 15 to 25 percent of the surface. In some places the subsoil is yellowish-brown coarse sandy clay loam or yellowish-red to red sandy clay loam or clay.

This soil is well drained to somewhat excessively drained. Permeability is moderately rapid. The available water holding capacity is moderate, root penetration is deep to very deep, and fertility is moderate. Runoff is rapid, and the erosion hazard is very severe.

Timber and light grazing are the principal uses of this soil. The forage consists of browse and some grass. If this soil is well managed, trees on it grow rapidly and are of high quality. Because of the very steep slopes, special practices are required when logging is done. The soil is subject to severe erosion if the forest cover is removed completely through harvesting or by fire. Capability unit VIIs-1(22); woodland suitability group 4.

Shaver very rocky coarse sandy loam, moderately deep, 51 to 71 percent slopes (SdF).—Areas of this very steep soil are on canyon slopes and ridges. The soil is moderately deep, but it is otherwise similar to Shaver very rocky coarse sandy loam, 51 to 71 percent slopes. Depth to weathered bedrock ranges from 25 to 35 inches.

This soil is somewhat excessively drained. The available water holding capacity is moderate, and root penetration is moderately deep to deep. Runoff is very rapid, and the erosion hazard is very severe.

Timber and light grazing are the principal uses for this soil. Trees grow at a moderate rate and are of good quality. Because of the steep slopes and hazard of erosion, special practices are required when logging is done, and adequate vegetation should be left on the areas. Capability unit VIIs-81(22); woodland suitability group 8.

Shenandoah Series

In the Shenandoah series are moderately well drained to somewhat poorly drained, moderately deep, light brownish-gray soils. These soils have a subsoil of heavy clay. They formed in material from granitic rock. Shenandoah soils are gently sloping. They are in concave slopes at elevations from 1,500 to 2,500 feet in and near the Shenandoah Valley. The vegetation is mostly grass, but it includes a few scattered oaks and conifers.

The surface soil, a light brownish-gray to pale-brown loam, is friable and medium acid. The subsoil is light grayish-brown to light yellowish-brown clay. It is plastic and medium acid. The profile has brown to dark-brown mottles near the surface, and these are light olive brown with increasing depth. Depth to the clay subsoil ranges from 20 to 36 inches, but depth to decomposed rock ranges from 30 to 58 inches. These soils are seasonally wet for long periods after the winter rains. In some places they contain a few rock fragments.

Shenandoah soils are used mainly for grazing. A small acreage is planted to hay or grain.

Shenandoah loam, 3 to 9 percent slopes (SfB).—This is the only soil of the Shenandoah series mapped in the Area. It is gently sloping and is in concave swales and on foot slopes. Some areas are gullied by drainage channels.

Representative profile in an area that formerly was cultivated but is now under grass:

0 to 6 inches, light brownish-gray loam; massive; slightly hard when dry, friable when moist; porous; medium acid.
6 to 24 inches, pale-brown loam with dark-brown to brown mottles; massive; slightly hard when dry, friable when moist, slightly sticky and slightly plastic when wet; porous; medium acid in the upper part, but strongly acid in the lower 7 inches.
24 to 32 inches, light brownish-gray clay with light olive-brown mottles; blocky structure; extremely hard when dry, very firm when moist, sticky and plastic when wet; medium acid.
32 to 40 inches, light yellowish-brown and light olive-brown sandy loam with white specks; massive; very hard when dry, very firm when moist, slightly sticky when wet; medium acid; granitic rock structure is evident in places.
40 to 46 inches +, massive to platy, weathered granitic rock.

Generally, this soil is moderately well drained, but in some places it is somewhat poorly drained. The surface soil ranges from light brownish gray to grayish brown. The subsoil is mostly clay, but in places it is sandy clay.

Permeability of the surface soil is moderate, and that of the subsoil is slow to very slow. The available water holding capacity of this soil is high, root penetration is

moderately deep, and fertility is moderate. Runoff is slow to very slow, and the erosion hazard is slight to moderate.

Some areas, generally on higher adjoining slopes, are well drained. Also, some moderately well drained areas have a subsoil of sandy clay loam.

Most of Shenandoah loam, 3 to 9 percent slopes, is used for grazing cattle, sheep, and goats. Because of favorable moisture conditions, yields of forage are fairly high. In better drained areas a small acreage is planted to hay and grain and to grapes. Crops on this soil respond if fertilizer that contains nitrogen and phosphate is applied, and if sulfur is added occasionally. It probably would not be economically feasible to drain wet areas artificially, because of the nearness of the claypan to the surface. Capability unit IIIw–3(18); range site 3.

Sierra Series

The Sierra series consists of well-drained, deep and moderately deep soils formed in material from granitic rock. These soils are gently sloping to very steep. They are on hills and knolls, on canyon slopes, and in mountainous areas at elevations of 1,000 to 2,500 feet. Sierra soils are in the Shenandoah Valley and adjoining areas in the north-central part of the Area. The vegetation is mostly grass, brush, and scattered oaks and conifers.

The surface soil, a brown to yellowish-red coarse sandy loam or loam, is friable and slightly acid to medium acid. The subsoil is yellowish-red to red heavy loam or clay loam. It is friable to firm and slightly acid to medium acid. These soils are gritty and micaceous throughout the profile. Depth to weathered bedrock ranges from 20 inches to more than 60 inches. The number of rock outcrops varies. In some places there are only a few rock outcrops, but in others rock outcrops occupy as much as 15 percent of the surface and the soil is very rocky.

Sierra soils are used for grazing and for dry-farmed walnuts, hay, and grain. A small acreage is used for irrigated pasture. At elevations of more than 2,000 feet are some minor stands of conifers that are cut for lumber. A large part of the land in the Amador Area that is used for cultivated crops is of this series.

Sierra coarse sandy loam, 9 to 16 percent slopes (SgC).—This soil is on rolling hills and convex knolls.

Representative profile from an area formerly cultivated but now under grass:

0 to 6 inches, brown coarse sandy loam; massive; slightly hard when dry, friable when moist; very porous; medium acid.
6 to 15 inches, yellowish-red loam; massive; very hard when dry, friable when moist, slightly sticky and slightly plastic when wet; porous; medium acid.
15 to 24 inches, yellowish-red heavy loam; massive; very hard when dry, friable when moist, slightly sticky and slightly plastic when wet; porous; medium acid.
24 to 45 inches, red heavy loam or clay loam; massive; very hard when dry, firm when moist, sticky and slightly plastic to plastic when wet; less porous than the horizon above; slightly acid.
45 to 66 inches, yellowish-red loam; massive; very hard when dry, firm when moist, sticky and plastic when wet; a few very fine pores; slightly acid.
66 to 73 inches +, reddish-yellow coarse sandy loam; massive with some evidence of the rock structure; hard when dry, friable when moist, and slightly sticky when wet; a few pores; medium acid.

The surface soil is mostly brown or yellowish brown, but it is reddish brown in places. Its texture is generally coarse sandy loam, but it ranges to loam. The subsoil is generally yellowish red or red, but it is reddish yellow in places at a depth below 5 feet. It contains 5 to 20 percent more clay than the surface soil and ranges from heavy loam to clay loam. Near bedrock the subsoil is medium acid in most places. Depth to weathered bedrock ranges from 30 to 70 inches but is predominantly more than 48 inches. In some areas there are a few granitic outcrops.

This soil is well drained. Permeability of the surface soil is moderate, and that of the subsoil is moderately slow. The available water holding capacity is high, root penetration is deep to very deep, and fertility is moderate. Runoff is medium, and the erosion hazard is moderate to severe. The soil is low in organic matter. It is fairly easy to work, but if it is too wet when cultivated, it becomes hard and cloddy on drying.

About 10 percent of the acreage of this mapping unit consists of moderately deep soil that has a brown subsoil. In a small acreage generally in swales and drainageways, the soil is moderately well drained or somewhat poorly drained. In forested areas are small areas of a soil that has a red, strongly acid subsoil.

Sierra coarse sandy loam, 9 to 16 percent slopes, is used mostly for range. A small acreage is used for dry-farmed hay and grain crops, for walnuts, and for vineyards. Water stored in small reservoirs on the farms is used mostly to irrigate small patches of pasture. Irrigation water is not available in most areas, but enough water could be obtained from the Cosumnes River to supply areas of this soil. Yields are low to fair, depending on management and the occurrence of frost, rainfall, high temperatures in summer, and other climatic factors. Forage plants and crops on this soil respond well if fertilizer that contains nitrogen and phosphate is applied. In some places sulfur is also needed.

If this soil is not adequately protected by vegetation, it erodes readily, especially during the rainy season. Working the soil at right angles to the slope helps prevent erosion if the soil is cultivated. Also, it is better to use chemical sprays for weed control than to disturb the soil by mechanical methods. Plowing under green-manure crops or adding plant residues and animal manures help improve tilth. Capability unit IVe–1(18); range site 3.

Sierra coarse sandy loam, 3 to 9 percent slopes (SgB).—This undulating to gently rolling soil is the most productive of the Sierra series. It is on smooth hills and concave foot slopes. Its slopes are gentler, but it is otherwise similar to Sierra coarse sandy loam, 9 to 16 percent slopes. Runoff is slow to medium, and the erosion hazard is moderate.

In places colluvium from steeper adjoining slopes caps the areas, and here the soil is very deep. In narrow stringers close to drainage channels, the surface soil is mottled in places because of seepage or because of runoff water. Some of these wet areas consist of Snelling loam, moderately well drained, or of Shenandoah loam. In a small acreage the subsoil is brown and loamy.

Sierra coarse sandy loam, 3 to 9 percent slopes, is commonly cropped to hay and grain or is used for grazing. A small acreage is used for vineyards and for walnut orchards. Lack of water for irrigation restricts the number of crops that can be grown. If this soil is left without adequate vegetation or is left finely tilled, it is subject to erosion. Also, this soil compacts and is difficult to work

into a seedbed if it is plowed when too wet. Capability unit IIIe–1(18); range site 3.

Sierra coarse sandy loam, 3 to 9 percent slopes, eroded (SgB2).—This gently rolling soil is on hills and concave slopes. It has been cropped in the past and is now moderately eroded. As much as 50 percent of the surface soil has been lost through erosion in places. Here rills and gullies are evident. The present surface layer is mostly yellowish-red loam because it is mostly material from the lower part of the original surface soil. Runoff is medium, and the erosion hazard is moderate to severe. Fertility is moderate to low.

Most of this soil is used for grazing. On moderately eroded areas the cropping system used is hay and grain for 2 years and then pasture for 4 years (fig. 23). Vines

Figure 23.—**Areas of Sierra coarse sandy loam, 3 to 9 percent slopes, used for grain and hay and stripcropped.**

standing on pedestals in old vineyards are still producing in places. Some areas used for grain and hay are cultivated and seeded in the fall before the rainy season, but some areas used for orchards and vineyards are left without adequate vegetative cover. In some places tillage is done up and down the slope.

Range on this soil is generally weedy and invaded by less desirable plants. The range can be restored by permitting only light grazing and reseeding bare spots with suitable grasses and legumes. In this way, the more desirable grasses will be reestablished. Planting cover crops in orchards and vineyards and plowing them under late in spring after the rainy period help to conserve soil moisture. Before the rains come, areas in hay and grain should be stubble mulched or tilled and left cloddy. Capability unit IIIe–1(18); range site 3.

Sierra coarse sandy loam, 9 to 16 percent slopes, eroded (SgC2).—This strongly sloping soil is on hills and ridges and is moderately eroded. Formerly, the areas were cropped and poorly managed. Except for erosion, the soil is similar to Sierra coarse sandy loam, 9 to 16 percent slopes. In places there are gullies that cannot be crossed by farm machinery. Sheet erosion and rills are common in cultivated areas. Runoff is medium, and the hazard of further erosion is moderate to severe.

This soil is used chiefly for grazing and for hay and grain. Vines in remnants of old vineyards produce low yields, and some of the vineyards are abandoned. This soil is best suited to grazing, but it can be used periodically for crops if it is carefully managed. Capability unit IVe–1 (18); range site 3.

Sierra coarse sandy loam, 16 to 31 percent slopes (SgD).—Areas of this moderately steep soil are on prominent hills and canyon slopes adjacent to rivers and creeks. Conifers, brush, and black oaks are on some areas at elevations above 2,000 feet or on north slopes. On cleared areas, the vegetation is mostly grass and scattered oaks.

The surface soil is thin in places. It ranges from 6 to 10 inches in thickness and in places is grayish brown. Rock outcrops occur in a few places, generally near ridge crests. Runoff is rapid, and the erosion hazard is severe.

In a small acreage the subsoil is brown. In forested areas the subsoil is red and strongly acid.

Sierra coarse sandy loam, 16 to 31 percent slopes, is used mostly for range. Its use for crops is limited by the slope and the risk of erosion. Careful clearing or thinning of the dense stands of brush and oak helps provide more forage for grazing. The conifers can be selectively cut for lumber and poles. Deteriorated range can be made more productive if annual or perennial grasses and legumes are seeded. Capability unit VIe–1(18); range site 3.

Sierra coarse sandy loam, 16 to 31 percent slopes, eroded (SgD2).—As much as 50 percent of the surface layer of this soil has been lost through erosion, and rills and small gullies are evident. Fertility is moderate to low. Runoff is rapid, and the erosion hazard is severe.

This soil is best suited to grazing. Some areas have, however, been periodically cropped to hay and grain or planted to vineyards. Practices that are suitable for use on other Sierra coarse sandy loams can be applied on this soil. Capability unit VIe–1(18); range site 3.

Sierra very rocky coarse sandy loam, 16 to 31 percent slopes (SkD).—Areas of this moderately steep soil are on knolls and side slopes. Rock outcrops occupy from 5 to 15 percent of the surface. On some areas on north slopes or at elevations above 2,000 feet, the vegetation is forest-browse. On cleared areas, the vegetation is grass. Runoff is rapid, and the erosion hazard is severe.

In some places, generally in forested areas, the subsoil is red and strongly acid.

Sierra very rocky coarse sandy loam, 16 to 31 percent slopes, is used mostly for grazing, but a small acreage of soil between the rocks is planted to walnuts and vineyards. The areas are difficult to manage, and production is poor. This soil is best suited to grazing or, where stands of conifers are established, to timber. Capability unit VIs–1(18); range site 3.

Sierra very rocky coarse sandy loam, 51 to 71 percent slopes (SkF).—This steep to very steep soil is on canyon slopes adjacent to rivers and streams and in mountainous areas. It is mostly near the Cosumnes River.

The surface soil ranges from 6 to 10 inches in thickness. It is mostly brown or pale-brown coarse sandy loam or fine sandy loam, but in some places it is yellowish red. The subsoil is brown or yellowish-brown clay loam in some places. In other places the subsoil is red, strongly acid clay loam. Rock outcrops occupy from 5 to 15 percent of the surface. This soil is in a transitional zone

between grass-oak areas and forest-woodland areas. Runoff is very rapid, and the erosion hazard is very severe.

Steep slopes and rocks limit the use of this soil. It is therefore used for light grazing and for timber. Adequate vegetation should be left on this soil at all times to prevent erosion. Capability unit VIIs–1(18); range site 3.

Sierra coarse sandy loam, moderately deep, 3 to 9 percent slopes (ShB).—This gently rolling soil is on smooth hills and concave slopes. The surface soil, a reddish-brown, brown, or yellowish-red coarse sandy loam or loam, is medium acid and 5 to 10 inches thick. The subsoil is yellowish-red or red heavy loam or clay loam and is slightly acid to medium acid. Depth to weathered bedrock is from 22 to 40 inches. There are a few granitic outcrops in some places.

This soil is well drained. The available water holding capacity is moderate, and root penetration is deep to moderately deep. Runoff is medium, and the erosion hazard is moderate. Probably this soil is moderately deep because of past erosion or because the parent rock is more resistant to weathering than that in the deeper Sierra soils. Little evidence of rilling or of soil loss is apparent, however, and the fertility of this soil is about the same as that of the deeper Sierra soils.

As much as 10 percent of this soil has a subsoil of brown loam. In a small acreage, generally in low swales affected by runoff water and seepage, are areas of Shenandoah loam and of Snelling loam, moderately well drained.

Sierra coarse sandy loam, moderately deep, 3 to 9 percent slopes, is used mostly for grazing, hay, and grain crops. A small acreage is planted to wine grapes and walnuts. Yields are highly variable, depending upon management and climatic factors, but they are generally low to fair. This soil erodes if left finely tilled in fall before the winter rains. Stubble mulching and tilling across the slope help control erosion. Capability unit IIIe–8(18); range site 3.

Sierra coarse sandy loam, moderately deep, 3 to 9 percent slopes, eroded (ShB2).—Areas of this gently rolling soil are on hills and concave slopes. Because of past cropping, this soil is moderately eroded in many areas. As much as 50 percent of the original surface layer is lost in places. The present surface soil is loam in places, and it generally is yellowish red because material from the subsoil has been mixed with the remaining original surface soil. Rills and gullies are evident in some cultivated areas. The structure of this soil is poor; the soil is very hard when dry and difficult to work. Root penetration is moderately deep, and fertility is moderate to low. Runoff is medium. The erosion hazard is moderate to severe.

This soil is commonly used for range, but it is occasionally cropped to hay and grain. Yields are low. A small acreage is in old deteriorated or abandoned vineyards. The soil is better suited to permanent pasture than to other permanent cover.

Range on this soil is commonly invaded by weedy forbs and less desirable grasses; yields are low. Practices that would help restore the range include the following: Seeding bare spots with suitable grasses and legumes and fertilizing with ammonium phosphate; applying animal manure; permitting only light grazing after the first year; and controlling grazing of livestock by fencing the areas and placing facilities for watering and salting in strategic spots. After fertility has been built up and the tilth and the structure of the soil have been improved, this soil could be used for a rotation of hay and grain crops or it could be used for vineyards. Lack of irrigation water limits the choice of crops. Capability unit IIIe–8(18); range site 3.

Sierra coarse sandy loam, moderately deep, 9 to 16 percent slopes (ShC).—Areas of this soil are strongly sloping or rolling. This soil is generally less than 40 inches deep, but it is otherwise similar to Sierra coarse sandy loam, 9 to 16 percent slopes. Runoff is medium to rapid, and the erosion hazard is moderate to severe.

In places as much as 10 percent of this mapping unit has a subsoil that is brown and loamy.

Sierra coarse sandy loam, moderately deep, 9 to 16 percent slopes, is used for grazing and for crops grown in rotation with pasture, hay, and grain. A small acreage is planted to wine grapes. The soil is highly erodible if left without adequate cover or if it is left finely tilled. If this soil is irrigated, the water should be applied, preferably by sprinklers, at a rate consistent with the rate of intake of water into the soil. The content of organic matter can be increased and tilth improved by turning under green-manure crops and applying animal manure. Crops on this soil respond well if fertilizer that contains nitrogen and phosphate is applied and if sulfur is added occasionally.

This soil is best suited to pasture and other crops that provide permanent cover and to only periodical use, perhaps 1 out of 4 years, for a rotation of hay and grain. Vineyards can be interplanted with cover crops, and the cover crops can be incorporated in the soil after the rainy season. Capability unit IVe–8(18); range site 3.

Sierra coarse sandy loam, moderately deep, 9 to 16 percent slopes, eroded (ShC2).—Areas of this soil are on rolling hills and rounded ridges. Because of past cultivation, most of this soil is moderately eroded and contains rills and small gullies. Root penetration is moderately deep, and fertility is moderate to low. Runoff is medium to rapid, and the erosion hazard is severe.

This soil is now used mostly for range, but formerly most areas were cropped to hay and grain. The soil is better suited to crops that provide a permanent cover, planted in rotation with hay and grain, than to other kinds of crops. Practices that control erosion and improve yields are needed. Capability unit IVe–8(18); range site 3.

Sierra coarse sandy loam, moderately deep, 16 to 31 percent slopes (ShD).—This moderately steep soil is on hills that are generally rounded and smooth, but that are dissected by small drainageways and creeks. The surface soil is yellowish red to reddish brown and in places is fine sandy loam or loam. Typically, the subsoil is yellowish-red or red loam or clay loam. In a few places granitic boulders outcrop.

The available water holding capacity is moderate, and root penetration is moderately deep. Runoff is rapid, and the erosion hazard is severe.

In a small acreage the subsoil is brown and loamy. In some forested areas the subsoil is strongly acid.

Sierra coarse sandy loam, moderately deep, 16 to 31 percent slopes, is used mostly for grazing. Slopes and susceptibility to erosion restrict the use of the soil for crops. Capability unit VIe–1(18); range site 3.

Sierra coarse sandy loam, moderately deep, 16 to 31 percent slopes, eroded (ShD2).—In this soil, rills and small gullies are apparent in cultivated fields and vineyards. The surface soil is generally yellowish red and less

than 8 inches thick. Fertility is moderate to low, runoff is rapid, and the erosion hazard is severe to very severe.

Most of this soil formerly was cropped to hay and grain, but it is now used as range for cattle, sheep, and goats. A small acreage is still used periodically for hay crops or consists of old vineyards. Deteriorated range can be improved by seeding more productive grasses and legumes and applying fertilizer that contains ammonium phosphate. Severely deteriorated areas should be lightly grazed. Capability unit VIe–1(18); range site 3.

Sierra very rocky coarse sandy loam, moderately deep, 9 to 31 percent slopes (SmD).—This rolling to hilly soil is on uplands. The surface soil is commonly reddish brown to yellowish red, but in places it is grayish brown. In places rock outcrops occupy as much as 15 percent of the surface and rocky fragments in the profile range from 5 to 30 percent of the soil mass, by volume. Depth to bedrock is variable; it ranges from 22 to 40 inches.

The available water holding capacity is moderate, and root penetration is moderately deep. Runoff is medium to rapid, and the erosion hazard is moderate to severe.

In places as much as 10 percent of this mapping unit consists of very rocky loam that has a brown loamy subsoil. In areas that are covered with conifers, the soil generally has a strongly acid subsoil.

Sierra very rocky coarse sandy loam, moderately deep, 9 to 31 percent slopes, is used mostly for grazing. In some areas on north-facing slopes or at elevations above 2,000 feet, there are scattered pockets of conifers used for lumber. If this soil is well managed and climatic conditions are favorable, desirable forage plants on it make good yields. If the areas are overgrazed, the soil is subject to erosion. Thinning heavy stands of brush and oak helps increase yields of forage. Capability unit VIs–1(18); range site 3.

Sierra very rocky coarse sandy loam, moderately deep, 31 to 51 percent slopes (SmE).—Areas of this steep soil are on canyon slopes adjacent to rivers and streams and on prominent hills. On the higher elevations or on the protected north slopes, there are small stands of conifers and hardwoods. Runoff is very rapid, and the erosion hazard is very severe.

Because of steep slopes and rock outcrops, this soil is better suited to grazing than to other uses. If poles, lumber, and firewood are cut from wooded areas, adequate vegetative cover should be left to prevent erosion. Some areas are steep and rocky, and these are best left as protected watershed or used for recreation or wildlife. Capability unit VIIs–1(18); range site 3.

Sierra sandy clay loam, 9 to 31 percent slopes, severely eroded (SlD3).—This soil is on rolling to hilly terrain on moderately steep hills and ridges and on foot slopes of steeper areas. It is commonly dissected by rills and gullies. Most of the surface soil, and in places, as much as 25 percent of the subsoil have been lost. Where these areas are dissected, the present surface soil is commonly red or yellowish-red sandy clay loam or loam, similar to the subsoil of Sierra coarse sandy loam, 9 to 16 percent slopes. Depth to weathered bedrock ranges from 20 to 40 inches.

Permeability of this soil is moderately slow, and the available water holding capacity is moderate. Root penetration is mostly moderately deep, but in some places roots penetrate the weathered bedrock. Fertility is low. Runoff is rapid to very rapid, and the erosion hazard is severe.

This soil has some value for grazing, but yields are low. The plants consist of woody forbs and less desirable grasses. Protective vegetation should be reestablished, but reseeding some areas would be difficult because of gullies. In some areas a partial seedbed can be prepared by tilling the soil lightly and then broadcasting the seed. Applying fertilizer that contains nitrogen and phosphate helps restore fertility. The range should be grazed lightly to permit the forage plants to recover. Grazing can be regulated by fencing the areas and placing stock-watering ponds and salting blocks in strategic spots. Capability unit VIIs–1(18); range site 3.

Sites Series

In the Sites series are well-drained, deep and moderately deep soils. These soils formed in material weathered from metasedimentary rock, mostly slate, schist, and intrusive rock. Sites soils are gently sloping to very steep. They are on mountain slopes and on ridges at elevations of more than 1,500 feet in the eastern part of the Area. Conifers, hardwoods, brush, and grass make up the vegetation.

The surface soil, a brown or reddish-brown gravelly loam or silt loam, is friable and granular and slightly acid to medium acid. The subsoil is reddish-brown to yellowish-red firm clay or clay loam. It is generally medium acid, but near bedrock it is strongly acid. In most places there are varying amounts of slaty fragments in the profile. The fragments range from gravel to large stones. Depth to bedrock is from 28 to more than 60 inches.

Sites soils are used mostly for timber and grazing. Cleared areas are used mostly for grazing, but a small acreage is planted to wine grapes, walnuts, apples, hay, and grain.

Sites very rocky loam, 16 to 51 percent slopes (SrE).—This moderately steep to steep soil, the most extensive of the Sites series, is on mountainous slopes and ridges.

Representative profile in an old walnut orchard that has been invaded by conifers and hardwoods:

½ inch or less of pine needles, oak leaves, and in some places, matted grass; decomposing in the lower part.
0 to 8 inches, brown gravelly loam; granular structure; slightly hard when dry, friable when moist, slightly plastic when wet; slightly acid.
8 to 15 inches, reddish-brown gravelly heavy loam; massive, but breaks to granular structure; this layer is otherwise similar to the layer above.
15 to 35 inches, reddish-brown gravelly clay loam; slightly sticky when wet but otherwise similar to the layer above.
35 to 67 inches, yellowish-red gravelly clay; massive; slightly hard when dry, firm to very firm when moist, slightly sticky and plastic to slightly plastic when wet; slightly acid, but medium acid near the lower boundary.
67 to 72 inches, brownish-yellow gravelly loam mixed with decomposing schist; massive.
72 inches +, very dark bluish gray schist with yellowish-red and light olive-brown coatings; fine grained; somewhat weathered but hard.

The surface layer is brown, yellowish brown, or reddish brown, and in some places it is silt loam. The subsoil is reddish brown, red, or yellowish red. Its texture is generally clay, but in places it is clay loam. Depth to bedrock ranges from 28 to 84 inches, but it is dominantly 45 to 60 inches. Rock outcrops occupy as much as 25

percent of the surface in places. Slaty rock fragments comprise from 5 to 35 percent of the soil mass, by volume. The bedrock is tilted nearly vertical, and depth to bedrock varies within short distances.

This soil is well drained. Permeability of the surface soil is moderate, and that of the subosil is moderately slow. The available water holding capacity is high to very high, root penetration is deep, and fertility is moderate. Runoff is medium to very rapid, and the erosion hazard is severe to very severe.

Mapped with this soil are some areas of very rocky loam that has a subsoil of brown or yellowish-red clay loam or silty clay loam. Also included are some areas on ridgecrests where the soil is shallow or very shallow over bedrock. In areas that adjoin granitic intrusions, the soil is micaceous in places.

Sites very rocky loam, 16 to 51 percent slopes, is used mostly for timber and for grazing in some places. Cleared areas are used for grazing, and in small isolated areas there are family-size apple and walnut orchards and vineyards.

The use of this soil for crops is limited because of climate, and because, in general, the soil is too rocky and steep for cultivation. If this soil is well managed, trees grow rapidly on it and are of high quality. Most areas have been logged in the past. The stands of timber are now mostly second- and third-growth pines. Capability unit VIs–1(22); woodland suitability group 3.

Sites loam, 3 to 9 percent slopes (SnB).—This gently sloping to moderately sloping soil is the best of the Sites series. It is in swales and concave foot slopes in narrow valleys. Some cleared areas have a cover of grass or are slowly reverting to fern, brush, or woodland. Because of colluvial sloughing from steeper adjoining slopes, this soil is commonly very deep (fig. 24). Slaty rock fragments the size of gravel are common in some places, but generally they do not interfere with tillage, nor do they materially reduce the available water holding capacity. Runoff is slow, and the erosion hazard is slight.

In some places this soil contains a few rock floaters and there are rock outcrops on the surface. Included in mapping with this soil are areas of other soils that are similar to those mapped with Sites very rocky loam, 16 to 51 percent slopes.

Some areas of this soil have been cleared and are used for vineyards, orchards, hay and grain, or pasture. On this soil, all of these crops respond if fertilizer that contains nitrogen and, especially, phosphate is applied. Yields are fair, depending on management and seasonal climatic factors. Cropland that is abandoned reverts to brush and woodland in a few years.

This soil is one of the best of the Sites series for timber, and most areas are used for timber and grazing. Capability unit IIe–1(22); woodland suitability group 1.

Sites loam, 9 to 16 percent slopes (SnC).—Areas of this strongly sloping soil are on foot slopes and sidehills. This soil has stronger slopes and a thinner surface soil, but it is otherwise similar to Sites loam, 3 to 9 percent slopes. The surface soil ranges from 6 to 10 inches in thickness. In a small acreage sheet erosion has occurred, and there are rills and small gullies in places. Runoff is slow to medium, and the erosion hazard is moderate.

This soil is used mostly for timber and grazing. Cleared areas are chiefly grazed or are cropped periodically to hay and grain, but there are a few small vineyards and orchards. If this soil is used for crops, cultivating across the slope helps control erosion. Areas that are in dry-farmed hay are more stable if left rough cloddy or if they are stubble mulched.

Figure 24.—**Profile of Sites loam, 3 to 9 percent slopes; the units on the rod are 1 foot each.**

This soil is better suited to timber or to a cover of permanent forage than to cultivated crops. Capability unit IIIe–1(22); woodland suitability group 1.

Sites loam, 16 to 31 percent slopes (SnD).—This moderately steep soil is on hills and ridges or on sidehills in mountainous areas. In some places this soil is slightly eroded to moderately eroded, and as a result, there are rills and small gullies in places. The surface soil commonly contains more slaty fragments than that of the less steep Sites loams. It ranges from 6 to 10 inches in thickness. Runoff is medium to rapid, and the erosion hazard is severe.

This soil is best suited to timber and light grazing and is mostly used for those purposes. Some cleared areas are used for grazing or are periodically cropped to grain and hay. The soil erodes if left bare or finely tilled during the rainy season. It is better suited to pasture and other permanent cover crops than to annual hay crops. If this soil is well managed, good stands of rapid-growing timber can be produced with little hazard to the soil. Capability unit IVe–1(22); woodland suitability group 3.

Sites loam, 31 to 51 percent slopes (SnE).—This steep soil is on mountainous areas that drop to streams and small drainageways. In some areas this soil is slightly to moderately eroded. Here the surface soil is gravelly and there are minor rills and gullies. In these eroded areas,

the vegetation has generally been removed by past fires, and the areas are now brushy. Most areas have regrowths of conifers and hardwoods. Runoff is rapid, and the erosion hazard is very severe.

Most of this soil is used for timber, to which it is well suited. If it is well managed, this soil produces fast-growing trees of high quality. Because of steep slopes, care is needed when logging is done. Good logging practices include the following: Providing turnouts and culverts on access roads to control runoff water; felling trees in line with the direction of skidding; limiting the number and size of skid trails; placing slash and other material in the skid trails; and leaving a suitable number of seed trees to ensure reproduction. Capability unit VIs–1(22); woodland suitability group 3.

Sites very rocky loam, 3 to 16 percent slopes (SrC).—This soil is on undulating to rolling hills and ridges and on strongly sloping foot slopes in mountainous areas. Rock outcrops occupy 10 to 25 percent of the surface. Loose slaty fragments comprise from 5 to 35 percent of the soil mass, by volume. Depth to bedrock ranges from 30 to more than 60 inches. In some places the soil is slightly to moderately eroded and has a dense cover of brush. Runoff is slow to medium, and the erosion hazard is slight to moderate.

In general, this soil is too rocky for cultivation; cleared areas are used for grazing. The soil is one of the best of the Sites series for timber and has some value for grazing. Capability unit Vs–7(22); woodland suitability group 1.

Sites very rocky loam, 51 to 85 percent slopes (SrF).—This very steep soil is on mountainous slopes and ridges. The surface soil is thin in places; it ranges from 6 to 10 inches in thickness. Depth to bedrock is variable, depending largely upon the direction and angle of incline of the rock strata to the slope. Depth to bedrock ranges from 45 to 60 inches. In some places the subsoil contains less clay than in the representative profile described and is clay loam. In places past fires have destroyed the timber, and these areas are moderately eroded and brushy. Runoff is very rapid, and the erosion hazard is very severe.

Although this soil is used largely for timber, it also provides some forage for limited grazing. Large areas are used solely for protected watershed and as browse areas for wildlife. This soil is best used as protective watershed. If access roads are available, trees can be harvested in some places if special logging practices are used. Capability unit VIIs–1(22); woodland suitability group 4.

Sites loam, moderately deep, 3 to 16 percent slopes (SoC).—This soil is on rolling hills and ridges. Some areas have dense stands of brush on them and a few conifers and hardwoods, but most areas have fair stands of second-growth conifers and some hardwoods.

The surface soil is commonly reddish-brown or yellowish-red loam 4 to 10 inches thick. The subsoil is red or yellowish-red silty clay loam or clay and generally contains less clay than the subsoil of the representative profile described for the series. Depth to bedrock ranges from 26 to 48 inches. Probably this soil is moderately deep because the parent material is harder and more resistant to weathering than that of the representative profile described and the rock bedding is almost at right angles to the direction of slope. Also, past erosion may be a factor.

The available water holding capacity is moderate, root penetration is moderately deep, and the erosion hazard is slight to moderate. Runoff is slow to medium.

In some places this soil has a subsoil of brown or reddish-yellow clay loam or silty clay loam. In other areas the soil is shallow over bedrock.

Sites loam, moderately deep, 3 to 16 percent slopes, is used mostly for timber and grazing. Cleared areas are used mostly for grazing or periodically are cropped to hay and grain. Yields of crops are fair to low. A small acreage is planted to wine grapes. If this soil is well managed, it produces good quality timber at a moderate rate of growth. On cleared areas, stands of grasses and forbs are fair, but brush, ferns, and woody plants quickly invade if not controlled. Dense brushy areas are commonly used as protected watershed or for wildlife. Capability unit IIIe–8(22); woodland suitability group 5.

Sites loam, moderately deep, 16 to 31 percent slopes (SoD).—This moderately steep soil is on slopes and convex ridge crests. Except for having moderately steep slopes, this soil is similar to the other moderately deep Sites soils. Runoff is rapid, and the erosion hazard is severe.

Although this soil is used mainly for timber, it has some value for grazing. Most cleared areas are used for grazing, but a small acreage is planted to dry-farmed hay and grain crops, or to wine grapes. If this soil is used for crops, tilling across slope and other practices that prevent erosion are needed. This soil is better suited to woodland, pasture, or other crops that provide permanent cover than to tilled crops. If the soil is well managed, it produces good quality trees at a moderate rate of growth. Capability unit IVe–8(22); woodland suitability group 6.

Sites loam, moderately deep, 31 to 51 percent slopes (SoE).—This steep soil is on mountainous slopes and ridges. The surface soil is yellowish red or red and is thin in places. It ranges from 6 to 10 inches in thickness. Generally, this soil contains slaty rock fragments the size of gravel, as well as a few stones. It is fairly free of rock outcrops. In a small acreage the soil is moderately eroded by water and is rilled. Runoff is very rapid, and the erosion hazard is very severe.

In a small acreage on narrow ridge crests, the soil is shallow to bedrock. As much as 10 percent of the acreage in places consists of soil that has a subsoil of brown or yellowish-red clay loam or silty clay loam.

Sites loam, moderately deep, 31 to 51 percent slopes, is too steep for cultivation. Therefore, it is used mostly for timber and light grazing. Some areas are cleared and are also used for grazing. If this soil is well managed, it produces moderately fast-growing stands of timber of good quality. Limitations to the use of logging equipment are moderate. Capability unit VIs–81(22); woodland suitability group 6.

Sites clay loam, moderately deep, 3 to 31 percent slopes, severely eroded (SpD3).—This gently sloping to moderately steep soil occupies areas that have been deeply gullied or rilled by water erosion. Most of the original surface soil has been lost. The present surface soil is mostly material from the former subsoil, which is reddish-brown, red, or yellowish-red clay loam. Depth to bedrock varies. The bedrock is partly exposed near gullies and where the soil is shallow over bedrock. In places depth to bedrock ranges from 15 to 36 inches.

Permeability of this soil is moderately slow. The available water holding capacity is moderate to low. Root penetration is moderately deep, and fertility is low. Runoff is medium to rapid. The erosion hazard is severe.

Areas of this soil were mostly planted to vineyards or

grain and hay at some time but were poorly managed and are now severely eroded. In old vineyards, vines occupy pedestals of soil held by their roots. Except for a few remnants of vineyards, which are low producing or are abandoned, this soil is now used mostly for light grazing. Some areas are reverting to brush, grass, hardwoods, and conifers, but bare spots are common.

The numerous gullies and low fertility make it difficult to restore areas of this soil, but some areas are suitable for replanting to conifers or grass. The soil is suitable for timber. Forage plants on this soil respond well if large amounts of fertilizer that contains nitrogen and phosphate are applied. Capability unit IVe–8(22); woodland suitability group 6.

Sites very rocky loam, moderately deep, 16 to 51 percent slopes (SsE).—This moderately steep to steep soil is on slopes and ridges. Rock outcrops occupy from 5 to 25 percent of the surface. Gravel and stone fragments make up from 15 to 30 percent of the soil mass, by volume. Runoff is rapid to very rapid, and the erosion hazard is severe to very severe.

In places as much as 10 percent of this unit consists of soils similar to those mapped with other soils of the Sites series.

Sites very rocky loam, moderately deep, 16 to 51 percent slopes, is suited only to timber and grazing, because of rocks and steep slopes. It is moderately productive of timber if well managed. Limitations to the use of equipment for logging or for mechanical planting of trees are severe. Capability unit VIs–81(22); woodland suitability group 7.

Sites-Mariposa complex, 16 to 51 percent slopes (StE).—This mapping unit consists of Sites very rocky loam, moderately deep, 16 to 51 percent slopes, and of Mariposa very rocky loam, 16 to 51 percent slopes. This complex is used mostly for timber and grazing. Cleared areas are used chiefly for grazing. Some areas have a dense cover of brush, and these are used mainly as watershed. The growth of ponderosa pine is variable on soils of this complex. The variation depends on the depth of the soil. Productivity of the Sites soil is moderate to high, but that of the Mariposa soil is low. The Sites very rocky loam is in capability unit VIs–81(22) and woodland suitability group 7. The Mariposa very rocky loam is in capability unit VIs–4(22) and Woodland suitability group 9.

Snelling Series

In the Snelling series are well-drained, deep, brownish soils formed in material from weakly consolidated granitic alluvium. The alluvium was deposited by the Mokelumne River or by an ancient drainage system that formerly criss-crossed the Area. These soils are nearly level to gently rolling and hilly. They are on benches and terraces, mainly adjacent to the Mokelumne River in the southwest corner of the Area. There are also small isolated areas along the western boundary of the Area. The vegetation is mostly grasses and forbs, but it includes a few oaks and digger pines.

The surface soil, a dark yellowish-brown or grayish-brown sandy loam or fine sandy loam, is porous and slightly acid. The subsoil is yellowish-red, yellowish-brown, or reddish-brown fine sandy loam or sandy loam, but it contains slightly more clay than the surface soil and is more compact. It is slightly acid or neutral. Also, the subsoil is commonly stratified with lenses of silt loam, sandy clay loam, or silty clay loam. Snelling soils are underlain at a depth of 40 to more than 60 inches by stratified sediments, or in places by clayey marine sediments, sandstone, rhyolitic tuff, or other unconforming bedrock. The profile is micaceous throughout.

Snelling soils are inextensive, and most areas will be covered by water backed up by the dam recently constructed near Camanche on the Mokelumne River. Now, the soils are commonly cultivated and used for hay, grain, wine grapes, and small family-size, deciduous orchards. Some undeveloped areas are used for grazing.

Snelling sandy loam, 9 to 16 percent slopes (SwD).—This strongly sloping soil, the most extensive of the Snelling series, is on terraces near the Mokelumne River and in isolated small areas along the western boundary of the Area.

Typical profile near the crest of an isolated terrace under grass-oak:

0 to 16 inches, brown to dark-brown sandy loam; single grain to weak granular structure; soft when dry, very friable when moist; porous; slightly acid.

16 to 24 inches, reddish-brown heavy sandy loam; massive, but breaks to weak blocky structure; soft when dry, friable when moist, slightly plastic and slightly sticky when wet; slightly acid.

24 to 36 inches, yellowish-red sandy clay loam; massive, but breaks to weak blocky structure; slightly hard when dry, friable when moist, plastic and sticky when wet; slightly acid.

36 inches +, reddish-yellow sandy clay loam with many fine grains of white quartz; massive; slightly hard when dry, friable when moist, plastic and sticky when wet; slightly acid.

Depth to the loosely consolidated substratum of stratified sandy loam, silt loam, or sandy clay loam ranges from 30 to more than 60 inches. The color of the surface soil is commonly brown, but it ranges from yellowish brown to grayish brown. Its texture ranges from fine sandy loam to sandy loam. This soil is micaceous and high in quartz minerals.

In a small acreage near the Mokelumne River, the soil, at a depth between 20 and 30 inches, is underlain by strongly cemented silt and sandstone, which is laminated and very hard. These areas generally are on ridge crests or on the tops of knolls.

In places a small acreage of this soil is shallow over rhyolitic tuff.

Snelling sandy loam, 9 to 16 percent slopes, is well drained. Permeability of the surface soil is moderately rapid, but that of the subsoil is moderate to moderately slow. The available water holding capacity is moderate, root penetration is deep, and fertility is moderate. Runoff is medium to rapid, and the erosion hazard is moderate to severe.

This soil is used mostly for grazing. Strong slopes and the hazard of erosion somewhat limit cultivation. The soil is better suited to pasture and other crops that provide permanent cover than to cultivated crops. If this soil is well managed, orchards and vineyards that are interplanted with cover crops can be grown. Range that is well managed is fairly productive. Crops on this soil respond if fertilizer that contains nitrogen and phosphate is applied and if sulfur is added occasionally. Capability unit IVe–1(18); range site 3.

Snelling sandy loam, 16 to 31 percent slopes (SwE).—This moderately steep soil is on terraces and escarpments

adjacent to the Mokelumne River. It is generally deep near foot slopes, but near bench tops the depth decreases. Characteristics of this soil are fairly variable because of sloughing from higher terraces. Runoff is rapid, and the erosion hazard is severe.

At present, this soil is used chiefly for grazing. Most of it will be inundated by reservoir water. Capability unit VIe–1(18); range site 3.

Snelling fine sandy loam, 0 to 2 percent slopes (SvA).—This nearly level soil is on terraces above the present stream channel of the Mokelumne River. It is deep over bedrock.

The surface soil, a brown or dark yellowish-brown fine sandy loam, is friable and slightly acid. The subsoil has little clay accumulation. It is yellowish-brown or reddish-brown fine sandy loam or sandy loam that is more compact than the surface soil but is friable and neutral. Depth to loosely consolidated, stratified sediments is generally below 48 inches.

The permeability of the surface soil is moderately rapid, but that of the subsoil is moderate. The available water holding capacity is high, root penetration is very deep, and fertility is moderate to high. Runoff is slow, and the erosion hazard is slight.

This soil is used for vineyards, hay, grain, and small deciduous orchards. It is in the reservoir area of a recently constructed dam near Camanche. Capability unit I–1(18); range site 3.

Snelling fine sandy loam, 2 to 5 percent slopes (SvB).—Areas of this gently sloping soil are on benches near the Mokelumne River. Its slopes are somewhat stronger, but it is otherwise similar to Snelling fine sandy loam, 0 to 2 percent slopes. Runoff is slow to medium, and the erosion hazard is slight to moderate.

This soil is used for hay and grain crops, for orchards, and for pastures. It is in the reservoir area of a recently constructed dam near Camanche. Capability unit IIIe–1(18); range site 3.

Snelling fine sandy loam, 5 to 9 percent slopes (SvC).—Areas of this soil are small. They are on terraces adjacent to the Mokelumne River and on isolated terraces several miles north of the River.

The surface soil is brown or reddish-brown fine sandy loam or sandy loam. The subsoil is yellowish-red to reddish-yellow sandy clay loam or heavy sandy loam. In some places on the tops of knolls, the soil contains lenses of massive, very hard silt and very fine sand at a depth between 20 and 30 inches. Runoff is medium, and the erosion hazard is moderate.

Because the areas are small and are commonly surrounded by areas too steep or stony for cultivation, this soil is used mostly for range. Some areas are cropped periodically to hay and grain, and a small acreage is planted to orchards. This soil produces good stands of grass for grazing if well managed. About one-half of the acreage is in the reservoir area of a recently constructed dam near Camanche. Capability unit IIIe–1(18); range site 3.

Snelling loam, moderately well drained, 0 to 9 percent slopes (SuB).—This soil is in swales and low drainageways or on flood plains.

Representative profile under grass in an area that formerly was cultivated:

0 to 11 inches, brown gritty loam; massive; hard when dry, friable when moist, slightly sticky and slightly plastic when wet; porous; strongly acid.
11 to 24 inches, brown gritty clay loam; massive; hard when dry, friable when moist, slightly sticky and slightly plastic when wet; porous; medium acid.
24 to 37 inches, pale-brown sandy clay loam; common, grayish-brown mottles; massive; very hard when dry, friable when moist, sticky and plastic when wet; many very fine pores; medium acid.
37 to 50 inches, pale-brown heavy coarse sandy loam; dark-brown mottles; massive; hard when dry, friable when moist, plastic and slightly sticky when wet; many very fine pores; medium acid.
50 to 60 inches +, pale-brown coarse sandy loam; dark-brown mottles; massive; slightly hard when dry, friable when moist, slightly sticky and slightly plastic when wet; many very fine pores; medium acid.

Depth to weathered granitic bedrock ranges from 40 to more than 60 inches. Where the soil is somewhat poorly drained, the surface soil is generally dark grayish brown, ranges from 10 to 20 inches in thickness, and in places is mottled with dark brown or brown. Where the soil is moderately well drained, it is generally mottled only in the subsoil.

This soil is moderately well drained to somewhat poorly drained. Permeability is moderate in the surface soil and moderately slow in the subsoil. The available water holding capacity is high, root penetration is deep, and fertility is moderate. Runoff is medium, and the erosion hazard is slight to moderate. This soil is subject to occasional flooding.

A small acreage of this soil, generally on higher adjoining slopes, is well drained.

Snelling loam, moderately well drained, 0 to 9 percent slopes, is generally used for grazing. In places, however, it is planted to grain and hay, and generally, seasonal wetness aids growth of these crops. Hay and pasture plants on this soil respond well if fertilizer that contains nitrogen and phosphate is applied and if sulfur is added occasionally. This soil would be good for growing other crops if irrigation water were available and applied carefully. The soil is easy to work, but in places artificial drainage is required for alfalfa and other deep-rooted crops. Capability unit IIw–2(18); range site 3.

Supan Series

The Supan series consists of well-drained, cobbly, very deep to moderately deep soils formed in material weathered from volcanic conglomerate. These soils are on gently sloping tabular ridges and steep to moderately steep side slopes that adjoin those ridges. Some small, isolated areas are on hills capped with conglomerate. Supan soils are scattered mainly in the west-central part of the Area at elevations of 500 to 2,000 feet. The vegetation is annual grasses and forbs, oaks in stands of mixed density, brush, and scattered digger and ponderosa pines.

The surface soil, a brown, dark-brown, or reddish-brown cobbly loam, is friable and neutral to medium acid. The subsoil is brown, yellowish-red, or reddish-brown cobbly clay loam, or it is sandy clay loam or clay in places near bedrock. It is neutral to medium acid. Depth to weathered, tuff-cemented conglomerate is 24 to 70 inches or more. In most places the soil contains large numbers of rounded cobblestones, mainly between 2 and 10 inches in diameter, and in places these occupy as much as 50

percent of the soil mass, by volume. The number of cobblestones increases with increasing depth.

Supan soils are used mostly for grazing. The many cobblestones generally hinder cultivation. A small acreage is planted to vineyards, and some areas are in urban uses.

Supan cobbly loam, 3 to 31 percent slopes (SxD).—Areas of this soil are on broad, smooth ridges. The slope is predominantly less than 9 percent. Some of the acreage is on side slopes that are as much as 31 percent.

Representative profile under annual grass in an area that formerly was plowed:

0 to 8 inches, reddish-brown cobbly loam; granular in the top 2 inches, but massive below; soft when dry, friable when moist; slightly acid.
8 to 16 inches, reddish-brown cobbly clay loam; massive; soft when dry, friable when moist; slightly acid.
16 to 38 inches, reddish-brown cobbly gravelly clay loam; massive; slightly hard to hard when dry, friable to firm when moist but slightly sticky in the lower 16 inches; neutral.
38 to 58 inches, reddish-brown cobbly sandy loam; massive; slightly hard when dry, friable when moist, plastic and slightly sticky when wet; mildly alkaline.
58 to 70 inches, reddish-brown cobbly gravelly loam with yellowish-red coatings; massive; very hard when dry, firm when moist, slightly plastic when wet; neutral.
70 to 75 inches +, weathered conglomerate; massive; contains andesitic cobblestones that are less weathered but darker with increasing depth; neutral.

Most of the cobblestones have been removed to a depth of 16 inches. The surface soil is predominantly loam, but it ranges toward loam, silt loam, or clay loam. It is neutral to slighly acid. The subsoil is nearly a clay in places, and it is medium acid to neutral. Depth to weathered conglomerate ranges from 40 to 70 inches. The conglomerate bedrock is variable; it is commonly stratified with lenses of siltstone, sandstone, or tuffaceous material that cements cobblestones, breccia, or mixed gravel. In places as much as 5 to 20 percent of the surface soil and 30 to 50 percent of the lower part of the profile, by volume, consists of cobblestones or other rounded stones.

This soil is well drained. Permeability of the surface soil is moderate, and that of the subsoil is moderately slow. The available water holding capacity is high, root penetration is deep, and fertility is moderate. Runoff is slow to rapid. The erosion hazard is slight on gently sloping ridges, but it is severe on the steeper side slopes.

Large areas of this soil were once used for dry-farmed hay and grain crops. These areas were improved in plowed areas by removing the stones by hand. Early ranchers and miners used the gently sloping areas for hay and grain for livestock. Now, much of this soil has reverted to annual range and is fairly productive. A small acreage is planted to vineyards. On this soil are homesites, the county airport, and other urban facilities.

Along one large area of this soil is a ditch owned by the Pacific Gas and Electric Company that supplies domestic water to the towns of Jackson and Sutter Creek. Although water from this ditch is available for irrigation, the increase in yields from crops suited to this soil would not warrant the cost. Annual range, grapes, and hay and grain crops on this soil respond well if fertilizer that contains nitrogen and phosphate is applied. Capability unit IVs–7(18); range site 1.

Supan very cobbly loam, moderately deep, 31 to 51 percent slopes (SyE).—This steep soil is on side slopes of hills capped by volcanic conglomerate.

Representative profile under grass-oak:

0 to 14 inches, dark-brown to brown very cobbly loam; granular structure; slightly hard when dry, friable when moist; slightly acid.
14 to 24 inches, brown very cobbly clay loam; massive to weak, subangular blocky structure; slightly hard when dry, friable when moist, slightly sticky and slightly plastic when wet; medium acid.
24 to 30 inches, brown very cobbly sandy clay loam; massive to weak, subangular blocky structure; hard when dry, friable when moist, slightly sticky and slightly plastic when wet; medium acid.
30 inches +, reddish-yellow partly weathered, tuffaceous material that cements cobblestones and other stones; extremely hard when dry and firm when moist.

This soil is moderately eroded in places. The surface soil in some places is reddish brown. It is nearly a silt loam or light clay loam in moderately eroded areas. The subsoil is brown or reddish brown and generally is clay loam; it is clay or sandy clay loam in places in the lower part. Because of colluvial sloughing, this soil is deep in places on lower foot slopes. Much of the profile is occupied by cobblestones and other stones, but the percentage varies, depending on cobbliness of the bedrock and movement of soil downslope by gravity.

This soil is well drained. Permeability of the surface soil is moderate, and that of the subsoil is moderately slow. The available water holding capacity is moderate, root penetration is moderately deep, and fertility is moderate. Runoff is very rapid, and the erosion hazard is very severe.

In places as much as 5 percent of this soil consists of very stony loams that are shallow over bedrock.

Supan very cobbly loam, moderately deep, 31 to 51 percent slopes, is used for grazing. If it is well managed, this soil produces good stands of desirable forage plants. The soil is steep enough that livestock trail around the slope rather than graze uniformly. Also, cobblestones are numerous enough to make footing for cattle unsure. Thinning brushy areas or removing the brush increases yields of grass. Capability unit VIs–81(18); range site 1.

Supan very cobbly loam, moderately deep, 3 to 31 percent slopes (SyD).—Areas of this moderately steep soil are small and are on isolated ridges and on side slopes. The surface soil is generally dark brown or brown. On nearly level ridge crests, however, it is slightly mottled in places because the bedrock is impervious. In places where the conglomerate is high in weatherable clay minerals, the lower part of the subsoil has a thin layer of clay. In places the conglomerate outcrops. Runoff is medium to very rapid, and the erosion hazard is moderate to very severe.

As much as 10 percent of this soil in areas on ridges consists of very stony loams that are shallow over bedrock.

Supan very cobbly loam, moderately deep, 3 to 31 percent slopes, is used for grazing. Cobblestones, however, hinder cultivation and also provide poor footing for cattle. Furthermore, large areas are brushy and require thinning to provide better grazing.

If this soil is well managed, it produces good yields of forage. Nevertheless, in places it is slightly less productive than Supan very cobbly loam, moderately deep, 31 to 51 percent slopes, because more of the acreage consists of soil that is shallow over bedrock or of areas that have outcroppings of conglomerate. Capability unit VIs–8(18); range site 1.

Tiger Creek Series

In the Tiger Creek series are well-drained, moderately deep, very rocky, dark reddish-brown soils. These soils formed in material from impurities weathered from recrystallized limestone. They are mostly steep and are on mountainous slopes and ridges at elevations from 2,000 to 3,000 feet. The areas are small and extend from Pine Grove northward to the El Dorado County line. Conifers, hardwoods, brush, and grass make up the vegetation.

The surface soil, a dark reddish-brown or reddish-brown loam, is very friable and is mildly alkaline. Generally, the subsoil is reddish-brown to dark reddish-brown clay loam that is firm and mildly alkaline. It is loam, however, in areas where the soil is shallow over bedrock. Depth to fractured bedrock ranges from 24 to 60 inches; the predominant range, however, is from 30 to 48 inches. Limestone outcrops occupy as much as 30 percent of the surface in some places. Fragments of lateritic iron and other impurities are common throughout the profile.

Tiger Creek soils are used mostly for timber and light grazing by livestock. Cleared areas are used for grazing.

Tiger Creek very rocky loam, 16 to 51 percent slopes (TcE).—This strongly sloping to steep soil is the only soil of the Tiger Creek series mapped in the Area. It is mostly on mountainous side slopes and ridge crests; a small acreage is on lower hills and flats near the town of Volcano.

Representative profile under a cover of mixed conifers and oaks:

2 inches or less of pine needles, oak leaves, and duff that is decomposing in the lower part.
0 to 6 inches, dark reddish-brown very rocky loam; granular structure; soft when dry, very friable when moist; slightly sticky and slightly plastic when wet; mildly alkaline.
6 to 15 inches, reddish-brown very rocky loam; massive to blocky structure; slightly hard when dry, friable when moist, slightly sticky and slightly plastic when wet; mildly alkaline.
15 to 26 inches, dark reddish-brown very rocky clay loam; massive; extremely hard when dry, firm when moist, sticky and plastic when wet; mildly alkaline.
26 to 54 inches +, dark reddish-brown extremely rocky loam; massive; hard when dry, friable when moist, slightly sticky and slightly plastic when wet; mildly alkaline.

Limestone fragments that range from 3 to 12 inches in diameter make up from 10 to 20 percent of the soil mass of the surface soil, from 20 to 50 percent of the upper part of the subsoil, and about 90 percent of the soil material below. Small lateritic fragments of iron and manganese are also in the soil in most places. Because the soil formed in material from impurities in the limestone, it is somewhat variable in color, reaction, and depth, depending on the type of impurities and the thickness of the limestone strata. If oxides of iron are prevalent, the soil is more red than the representative profile described. On the other hand, if slate and schist are near the surface, the soil is medium acid. Depth to bedrock is dominantly between 30 and 48 inches, but this changes quickly within short distances.

This soil is well drained. Permeability of the surface soil is moderate, and that of the subsoil is moderately slow. The available water holding capacity is moderate, root penetration is moderately deep, and fertility is moderately high. Runoff is rapid to very rapid, and the erosion hazard is very severe.

As much as 10 percent of the acreage of this soil consists of moderately deep soil formed in material from schist and slate, and as much as 10 percent is soil that is shallow over bedrock. About 5 percent consists of areas of Limestone rock land.

Because of steep slopes and rocks, the use of Tiger Creek very rocky loam, 16 to 51 percent slopes, is restricted to timber and light grazing. If the soil is well managed, trees on it grow at a moderately rapid rate and are of good quality. On the steep slopes, care is needed to prevent erosion when logging is done. Cleared areas on gentler slopes are used for grazing and are fairly productive. Capability unit VIs–81(22); woodland suitability group 7.

Windy Series

The Windy series consists of well-drained to somewhat excessively drained, cobbly, deep to moderately deep, dark grayish-brown soils formed in material weathered from volcanic conglomerate. These soils are in narrow areas on strongly sloping ridges and moderately steep to steep side slopes. They are at elevations of more than 5,000 feet between the Dew Drop Ranger Station and the eastern boundary of the Area. The vegetation is mostly conifers and oaks that have an understory of brush. In open or seep areas there is grass in places.

The surface soil, a dark grayish-brown sandy loam or fine sandy loam that is almost black when moist, is very friable and cobbly and is medium acid. The subsoil is dark brown, and its texture and reaction are similar to those of the surface soil. These soils are high in iron-manganese shot the size of gravel, and they contain abundant rounded cobblestones or angular pieces of breccia. The rock fragments become more numerous with increasing depth. Outcrops of conglomerate are also common. Depth to bedrock is from 30 to 50 inches.

Windy soils are used only for timber and in some places for summer grazing by cattle.

Windy cobbly sandy loam, 16 to 51 percent slopes (WcE).—This moderately steep to steep soil, the more extensive of the Windy series, is on slopes and adjoining ridge crests.

Typical profile under forest:

4 inches of less of pine needles, oak leaves, and twigs that are decomposing in the lower part.
0 to 15 inches, dark grayish-brown cobbly sandy loam; weak to moderate, medium, granular structure; loose to soft when dry, very friable when moist; medium acid.
15 to 49 inches, dark-brown cobbly fine sandy loam; moderate, medium to weak, fine, granular structure; loose when dry, very friable when moist; large roots begin to flatten out at a depth of 27 inches; medium acid.
49 inches +, partly weathered, hard breccia and conglomerate.

The texture of the surface layer ranges from fine sandy loam to sandy loam, and it is generally dark grayish brown to dark brown. Gravelly shot, cobblestones, or breccia comprise from 35 to 50 percent of the surface soil, by volume. The subsoil is dark brown to yellowish brown, and in places rock fragments make up 40 to 60 percent of the mass, by volume. Depth to bedrock ranges from 32 to 49 inches. Outcrops of conglomerate are common.

This soil is well drained to somewhat excessively drained. Permeability of the surface soil is moderate to moderately rapid, and that of the subsoil is moderately rapid. The available water holding capacity is low to moderate, root penetration is moderately deep to deep,

and fertility is moderate. Runoff is rapid to very rapid, and the erosion hazard is severe to very severe.

In some places this soil consists of moderately deep very cobbly loam or very stony loam that is shallow over bedrock, or of reddish-brown very cobbly loam with a finer textured subsoil.

Windy cobbly sandy loam, 16 to 51 percent slopes, is used for timber, and in some places in summer for grazing by cattle. If the soil is well managed, trees on it grow at a medium to high rate and are of good quality. Areas that have a dense cover of brush are used as protected watershed. Logging is hazardous in some steep areas. Capability unit VIs–81(22); woodland suitability group 7.

Windy cobbly sandy loam, 9 to 16 percent slopes (WcD).—This strongly sloping soil occupies narrow areas on ridges and on minor peaks. It has gentler slopes, but it is otherwise similar to Windy cobbly sandy loam, 16 to 51 percent slopes. Runoff is medium, and the erosion hazard is moderate to severe.

This soil is used for timber and for some grazing. Capability unit VIs–8(22); woodland suitability group 5.

Formation, Morphology, and Classification of Soils[5]

In this section are discussed the factors that affect soil formation, the morphology of the soils in the Amador Area, and the classification of the soils in higher categories.

Factors of Soil Formation

Soil has been defined as a natural body on the surface of the earth in which plants grow, composed of organic and mineral materials (*28*). Soils differ in their appearance, composition, management requirements, and productivity in different localities or even within very short distances in the same locality. The factors that cause soils to differ are (1) the physical and mineralogical composition of the parent material of the soil; (2) the relief or lay of the land; (3) the climate under which the soil material has accumulated; (4) the biological activity, including the plant and animal life in and on the soil; and (5) the length of time the forces of formation have acted on the soil material. Each soil is affected by all five factors, but the relative effect and importance of each varies from one soil to another.

Parent material and relief

The geology and the geomorphic history of the Area help to explain the relationship of parent material and relief to soil formation.

The Amador Area is in two geomorphic provinces, the Sierra Nevada section, and the Great Valley of California, or the California Trough. The Sierra Nevada section extends from the vicinity of Ione eastward beyond the boundary of the Area. The part within the Great Valley is smaller and is in the Arroyo Seco dissected pediment. It extends from the vicinity of Ione westward to the county line (*20*).

Fairly early in geologic time, the marine sediments interbedded with volcanic rocks in the Area underwent intense metamorphism and folding. As a result, nearly continuous belts of vertically tilted rocks with ridges that extend generally northwestward were formed. Later great quantities of molten material were intruded. Intrusions of diorite and gabbro were followed by development of the Sierra Nevada batholith which solidified into crystalline granitic rock. At that time the Area sloped more gently westward than it does today, though the crest of the Sierra Nevada was approximately in its present location. Then the surface of the folded sedimentary and volcanic rocks was lowered throughout a long period of erosion. Large areas of the granodiorite batholith were exposed, and sediments of clay and sand were deposited in a lagoon that extended westward from near Ione (*20*).

Later, much volcanic activity occurred in the Sierra region. Lava flows, mostly of andesite; volcanic mudflows; and volcanic dust covered most of the region. A volcanic plain was formed that sloped gently southwestward from the present summit of the Sierras and across the Sierra Nevada section to the Great Valley. Only a few peaks and ridges remained as islands above the volcanic plain. The geologic activity of this time marks the beginning of the present landforms and had a strong influence in developing the soil pattern of the Area (*20*).

It is estimated that the upper surface of the volcanic plain had a fairly uniform slope of about 100 feet per mile after volcanic activity ceased (*20*). From the eastern edge of the Great Valley, which is about 200 feet above sea level, to the crest of the Sierra Nevada, a few miles east of Amador County, is less than 60 miles. Thus, the summit would have had an elevation of less than 6,000 feet at that time. Volcanic debris filled the former drainage channels, and presumably a new drainage system evolved on the sloping plain. Research based on the potassium-argon dating technique shows that the uppermost part of the Mehrten formation was deposited 4 to 5 million years ago, and the lower part about 19.9 million years ago (*9*).

About the middle of Pleistocene time, or somewhat earlier (*20*), the western slope of the Sierra Nevada was uniformly tilted upward. The increase in slope has been estimated as about 90 feet to the mile, or an increase of about 5,400 feet in the elevation of the summit of the mountains (*15*). Round Top Mountain, 4 miles east of Amador County, has an elevation of 10,380 feet; thus, an estimated increase in height of the summit of the Sierra Nevada from 6,000 to 11,400 feet is reasonable. Erosion both by water and ice could account for much or all of the 1,000 feet difference between the estimated and recorded heights.

There is no evidence that the uplift was accompanied by major changes in stream patterns (*20*). However, the increased gradient of the streams accelerated the deepening of canyons. As a result, the streams are deeply entrenched, and in much of the area the volcanic plain has been eroded away or consists only of scattered high remnants on the broader and less eroded divides. If the elevations of the remnants of the volcanic plain are plotted on a graph in a transect from Round Top Mountain through Amador City (20° south of due west), a linear relationship exists. The average slope is about 165 feet in a mile, but the upper 34 miles has a slope of 175 feet in a mile, and the lower slope, about 125 feet in a mile. The change in grade occurs at an elevation of

[5] By GRANT M. KENNEDY, soil specialist, Soil Conservation Service.

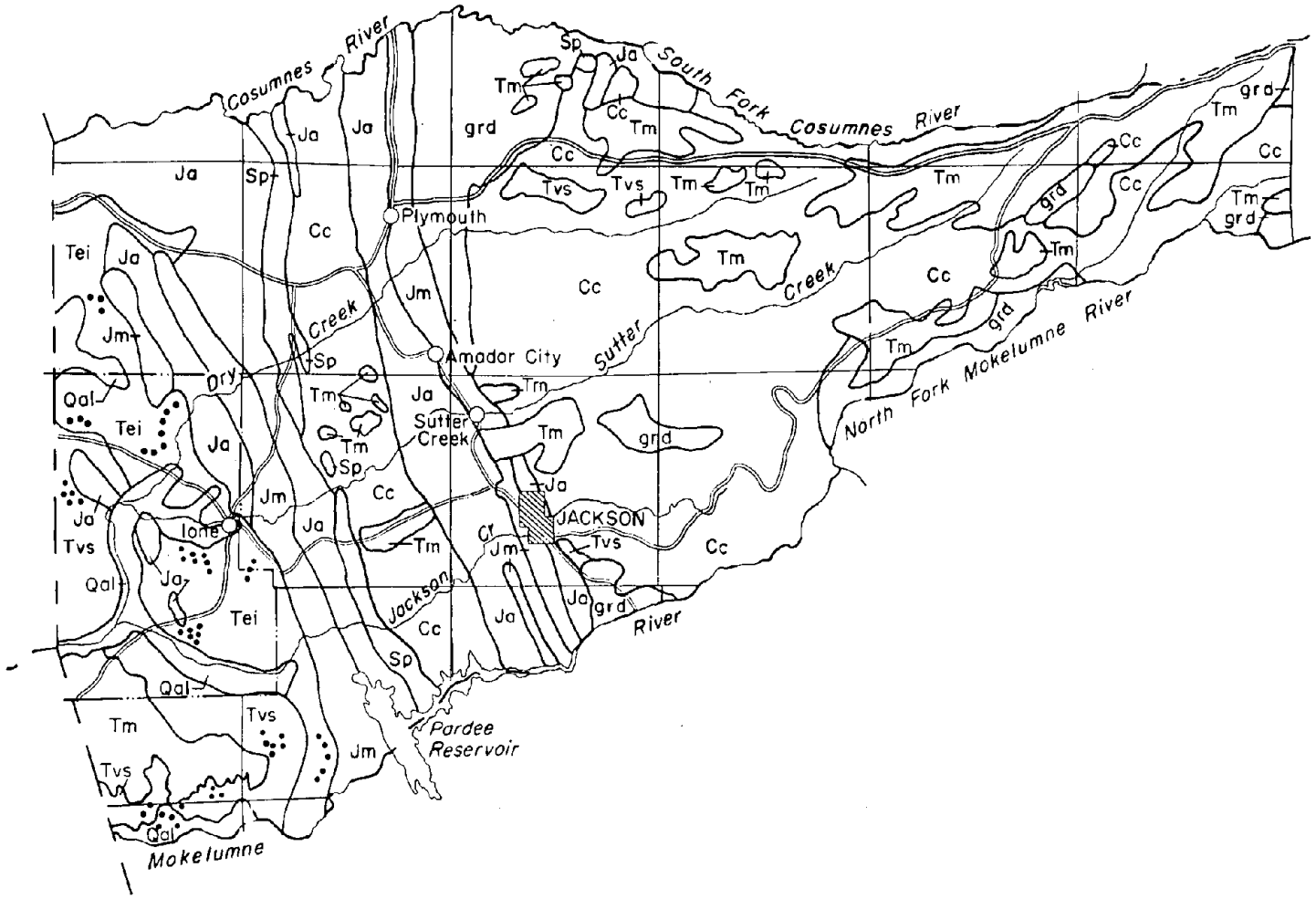


Figure 25.—**Geologic formations of the Amador Area: *Oal*, recent alluvium; *Tm*, Mehrten formation—cobblestones and fragments of porphyritic andesite and clay, mostly in a conglomerate, but small amounts of layered siltstone, sandstone, and clay mud rock; *Tvs*, Valley Springs formation—rhyolitic tuff breccia, some conglomerate, and mixed gravel; *Tei*, Ione formation—sandstone and clay, lignite beds, mixed gravel; *Jm*, Mariposa formation—dark slate and some conglomerate and schist; *Ja*, Amador group—metamorphosed volcanic rock, basic schist, meta-andesite, and conglomerate; *Cc*, Calaveras formation—schist quartzite, slate, and recrystallized limestone; *grd*, granitic rock, granodiorite, quartz diorite, and syenite; *Sp*, serpentine; dots indicate Arroyo Seco gravel and gravel of uncertain age.**

about 3,500 feet. Above this elevation, the divides are narrower than at lower elevations.

Sediments from erosion of the volcanic plain and underlying formations were carried into the Great Valley. The coarser materials accumulated along the eastern margin of the Great Valley in an area near Ione and extended westward to form the Arroyo Seco pediment. The materials that form this pediment are chiefly of rounded quartz and quartzite gravel and cobblestones from hard crystalline rocks of the Sierra Nevada. Such rocks are least likely to disintegrate in swift moving streams. The Arroyo Seco pediment mantles earlier deposits of clay, sand, and volcanic debris. Subsequent erosion dissected the broad plain, and in many places older formations are exposed, but generally remnants of gravel and cobblestones remain in a thin cap on the Arroyo Seco pediment.

The Sierra section of the Area consists of a series of southwestward sloping ridges separated by hilly uplands, narrow steep-walled canyons, and conspicuous knobs and peaks. The direction of most major drainageways is to the southwest, but that of minor drainageways in smaller longitudinal valleys is northwest to southeast. The major stream canyons and their tributaries are deeply entrenched and V-shaped. Stream grades are steep. Consequently, alluvial deposits are small and consist of coarse sediments along narrow stream channels.

Most of the soils in the Amador Area formed in place in material from schist, metamorphosed volcanic rock, slate, granodiorite, serpentine, limestone, quartzite, andesitic conglomerate, and breccia. The relative extent of the major formations in the Area is shown in figure 25. Boundaries of the geologic formations and the soil associations coincide in many places. The age of geologic formations in the Area, the formations, the type of rock, and the soils developed on each formation are shown in table 9.

The Windy, McCarthy, Cohasset, Aiken, Supan, and Iron Mountain soils are on ridges that slope southwestward. These ridges are remnants of the volcanic plain and consist of high tabular divides of andesite, breccia, and conglomerate. The broad ridges have gentle slopes.

TABLE 9.—*The age, geologic formations, type of rock, and soils developed on each formation in the Amador Area (7, 20)*

Geologic age	Formation	Type of rock	Soil series
Recent	Alluvium	Sand, silt, gravel, and clay	Honcut, Ryer, Snelling.
Pleistocene	Arroyo Seco gravel and gravel of uncertain age.	Waterworn cobblestones, pebbles, and sand	Pardee, Perkins, Red Bluff.
Pliocene	Mehrten	Andesitic conglomerate	Aiken, Cohasset, Inks, Iron Mountain, McCarthy, Pentz, Peters, Supan, Windy.
Middle Miocene	Valley Springs	Rhyolitic tuff, breccia, some conglomerate, and mixed gravel.	Iron Mountain, Jiggs, Laniger.
Middle Eocene	Ione	Sandstone, clay, and some mixed gravel	Mokelumne.
Jurassic	Granitic rock	Granodiorite and granite, quartz, diorite, syenite, and other intrusive rocks.	Ahwahnee, Holland, Musick, Shaver, Shenandoah, Sierra.
	Serpentine	Serpentine	Henneke.
	Mariposa	Slate	Auburn, Exchequer.
	Amador Group	Metamorphosed volcanic rock, basic schist, metaandesite, and conglomerate.	Argonaut, Auburn, Exchequer
Permian to Carboniferous.	Calaveras	Schist, quartzite, slate, and recrystalized limestone	Auburn, Exchequer, Fiddletown, Josephine, Mariposa, Maymen, Sites, Tiger Creek.

The andesite is mostly partly cemented conglomerate, but in the eastern part of the Area the andesite is mainly cemented breccia. Volcanic ash is probably a constituent of the rocks here, particularly at higher elevations.

Folded metamorphosed sediments, metavolcanic rocks, and other metamorphosed rocks underlie large areas. Characteristically, in these areas the topography is complex and hilly and has many narrow ridges that lie in a northwesterly direction. Narrow bands of rock outcrops or rock outcrops that resemble tombstones are common. Complex patterns of soils occur in areas underlain by metasediments. Such sediments were composed of various kinds of rocks and were stratified when deposited. Now, the rock is vertically tilted and the variability of the material is reflected in soil characteristics that change within distances of a few feet. The Mariposa, Josephine, and Sites soils are in this area, and they, for example, vary considerably within small areas in depth and color.

In general, metamorphosed rocks in the Area are not easily weathered. Soils formed in material from metamorphosed parent materials are generally shallow and gravelly. Strata of quartz, quartzite, and platy material remain in the soil as gravel-sized fragments. Also, the soils formed in such material are not high in fertility, probably because the sediments in the rocks were previously weathered in an earlier erosion cycle. For example, Sites, Josephine, and Mariposa soils are less fertile than adjacent Aiken and Cohasset soils formed in material from andesitic rock.

Narrow bands of serpentine, a strongly metamorphosed basic rock, underlie some areas. The Henneke soils formed in material from these deposits, and they are low in fertility. Because of the large amount of magnesium in relation to the amount of calcium in these soils, the uptake of calcium by plants is reduced and their productivity lowered (*29*).

Soils underlain by granodiorite occupy places where the overlying rocks were stripped away and the Sierra batholith is exposed. Here are soils of the Sierra, Musick, Ahwahnee, and Holland series. The largest area is east of Plymouth. The topography is hilly. The hilltops are rounded and convex, have fairly steep side slopes, and have somewhat concave foot slopes. The parent rock is weathered to a considerable depth and the soils are 3 to 5 feet deep. The weathered rock contains many angular coarse grains of sand, mainly of quartz, and the soils are sandy or nearly so. The abrasive action of the grains of sand carried by runoff water accounts for the susceptibility of the soils to erosion. Both sheet and gully erosion are common in cultivated fields. The rounded hills and depth of the soils indicate that geologic erosion also is relatively rapid.

The Arroyo Seco pediment extends northwest from Ione and also to the south. The pediment has been eroded. As a result, the Area now consists of widely scattered, flat-topped hills and gently sloping toe slopes. The soils on the hills contain some gravel and cobblestones, and gravel and cobblestones from the hills have been deposited on the toe slopes. These coarse sediments range from a thin veneer to more than 6 feet in thickness.

In the vicinity of Ione, gravel and cobblestones intermittently blanket extremely acid clay and sandstone. Soils formed in material from these sediments are of the Mokelumne series. These soils are very strongly acid and low in fertility. Soils formed where several feet or more of gravel overlies acid clay and sandstone are gravelly and are also acid and low in fertility. In these areas are the Red Bluff soils. Because of the intricate pattern of dissection of the areas, which left alternate patches of gravelly and cobbly alluvium and exposed clay and sandstone in places, the Red Bluff and Mokelumne soils are intermingled in many places and are mapped mostly as complexes.

In other places gravel and cobblestones from the Arroyo Seco pediment cap volcanic conglomerate and tuff, generally to a depth of 10 to 24 inches. The Pardee soils are in these places. Here the slope is smooth and gentle. The gravel and cobblestones on the surface reduce the rate of erosion.

Southwest of Buena Vista Peak a part of the dissected pediment has been stripped of practically all Arroyo Seco deposits and volcanic materials are exposed. Only a few quartzitic cobblestones remain on the surface. The area now consists of scattered, flat-topped hills with steep side slopes and of intervening flats between the hills. Cemented andesitic conglomerate underlies soils

on the tops of the hills and at different levels on the flat areas. The conglomerate is separated by strata of tuff and andesitic sandstone laid down on the old volcanic plain and then differentially eroded. Inks loam and Rock land are in areas underlain by andesitic conglomerate, and the Pentz soils are in areas underlain by tuff and andesitic sandstone.

Major stream channels have a reduced gradient below an elevation of about 200 feet. Sediments carried by Jackson, Sutter, and Dry Creeks have been deposited on the nearly level flood plains of small valleys. Extensive in the Jackson and Ione Valleys are the alluvial Honcut soils. Runoff is slow on some areas in the flood plains of major stream courses and on flats of the dissected pediment. Along the flood plains the water table is generally deep, but it rises to within 6 feet of the surface or less in wet seasons. In winter, ponds form in hummocky flats of the dissected pediment.

Climate

Climate has a marked influence on soil formation. Heat and moisture strongly influence the amount and kind of vegetation that grows, the rate at which organic matter decomposes, the rate at which minerals weather, and the removal of material from the different soil horizons or accumulation of material in them.

Temperature and precipitation in the Area vary according to elevation, except for some local differences. In the western part of the Area at an elevation of 300 feet, the annual precipitation is about 20 inches and the mean annual temperature is about 62°F. Generally, precipitation increases and temperature decreases regularly with increase in elevation. At an elevation of 4,800 feet, the annual precipitation is about 45 inches and the mean annual temperature is about 56°F., but at cooler temperatures much of the precipitation falls as snow.

The summers in the Area are hot and dry. Winters are cool and moist. In summer, rainfall ranges from almost none in the foothills to about 1 inch at the highest elevations. Precipitation increases slightly in September and October, reaches a maximum in January, and decreases rapidly in May and June. About 10 percent of the total precipitation comes during the months of May through October at the lower elevations, and about 20 percent at the higher elevations. Temperatures are highest in July and lowest in January.

The content of organic matter in the soils is largest at high elevations where the climate is cool and moist. At elevations of more than 4,800 feet, growth is not so rapid as at lower elevations, because of cool temperatures and the shorter growing season. Nevertheless, the soils are high in organic matter because roots of the plants are generally coarse and the cool temperatures do not favor rapid decomposition. At intermediate elevations rainfall is more abundant than at lower elevations, but temperatures are cooler. Vegetation is abundant; the plants have fairly coarse roots, and much plant residue is returned to the soil. Decomposition is rapid, but the soils retain a moderate amount of organic matter. At low elevations much of the vegetation consists of annual grasses and forbs. These plants have very fine roots. Even though the soils are nearly dry in summer and early in fall, the warm and moist weather in spring and late in fall favors rapid decomposition and the soils have a low content of organic matter. At low elevations the organic matter is highest where vegetation is mainly shrubs that have coarse roots.

Most likely the trend of increasing content of organic matter with increasing elevation and decreasing temperature reverses itself at elevations above those in the Area. The elevation and temperature at which the reversal occurs, however, have not been determined.

Rainfall in the Area is sufficient to leach the soils of lime and other water-soluble material. The annual precipitation ranges from 20 to more than 45 inches, and 80 to 90 percent of it falls from November through April. In these months rainfall exceeds losses of moisture by transpiration and evaporation. Surplus water during the wettest season ranges from 11 to more than 30 inches (*2*). The surplus water is retained by the soil, percolates through it, or is lost through runoff. Runoff, however, does not cause major loss of water in the Area. Thus, even at low elevations enough precipitation falls to leach most soils to a depth below 5 feet, but at higher elevations leaching is deeper. Leaching occurs in the soils in all parts of the Area. Evidences of this leaching are the absence of lime in all the soil profiles, except in soils derived from marble; the presence of clay films at considerable depths within many of the soils or within the weathered rock; and the acid reaction of the soils where precipitation is high.

Between elevations of about 2,000 and 4,800 feet, the soils appear to be undergoing the most intensive weathering in the Area. In general, the soils at these elevations have a thicker profile and a redder, finer textured Bt horizon than soils at higher or lower elevations. At lower elevations lack of moisture when the soils are warm probably limits the rate of weathering. On the other hand, cooler temperatures at higher elevations also limit weathering.

Effects of changes in climate on soils formed from similar parent material are evident in the soils of the Inks, Supan, Aiken, and Windy series. These soils formed in material from andesitic conglomerate of the Mehrten formation. The Inks soils are at elevations of about 500 to 1,000 feet, Supan soils at elevations of about 1,000 to 1,800 feet, Aiken soils at elevations of about 2,000 to 4,800 feet, and Windy soils at elevations of more than 4,800 feet. Progressing from the Inks to the Aiken soils, the thickness of the B horizon is greater, the hue is redder, the chroma higher, and the texture finer. The change from the Aiken to the Windy soil is fairly distinct. In contrast to the Aiken soils, which are very deep and have a B horizon of red clay, the Windy soils are moderately deep, have a thick, dark A horizon, but have no other distinct profile characteristics. All the soils have a very high cation-exchange capacity and probably contain considerable ash. Data from Amador and adjacent counties indicate that the total organic matter above bedrock in equal areas of Inks, Supan, Aiken, and Windy soils is in the ratio of less than 1, to 2, to 4, to 4 or more, respectively, at modal sites. The volume of fragments greater than 2 millimeters in diameter was considered in the calculations.

Biological activity

The vegetation from the western boundary of the Area eastward consists, in progression, of grass, of oak-grass intermingled in places with brush, of areas of oak-grass transitional to coniferous forests, and of coniferous forests. The pattern of vegetation has been affected

somewhat, because of changes caused by fires, grazing practices, clearing, and short periods of cultivation. Annual grasses and forbs are dominant in areas of grass and oak-grass. Many of these were introduced and replace native perennial bunchgrasses and other native plants (*5*).

Soils formed under grass and oak-grass have a fairly thin A horizon, about 6 to 9 inches thick, and contain relatively low amounts of organic matter. Vegetation on these soils has been grazed by livestock for more than a hundred years. The amount of plants left after grazing each year varies greatly according to grazing practices and seasonal growth. Under average grazing methods followed in the Area, yearly additions of organic residues to the soils are estimated to be between 400 and 1,500 pounds per acre of stems and leaves and about an equivalent weight of roots. Thus, about 800 to 3,000 pounds of organic matter are returned to the soil annually, mainly to the A horizon. Most of the soils contain between 1 and 2 percent of organic matter in the A horizon; thus, between 30,000 and 60,000 pounds would accumulate in the upper 9 inches of the soil in 20 to 40 years if no decomposition occurred. There is no evidence to indicate that the organic matter content of the soils is increasing. Consequently, it is assumed that micro-organisms cause the decomposition of the annual additions of organic matter. Earthworms are relatively rare in these soils. The fine roots of the annual grasses and forbs decompose readily.

At lower elevations west of Jackson, Sutter Creek, and Plymouth are extensive areas of brush. Here the soils are low in fertility and are susceptible to erosion. Stands of chamise on the Henneke soils and of chamise and dwarf manzanita on areas of Sedimentary rock land are typical of plants on soils that lack nutrients needed for growth of more desirable plants. This kind of vegetation does not adequately protect soils from erosion. The thick stands of brush are burned periodically, and in many places the soils underneath and adjacent to the brush are left bare. Additions of organic matter to the soils are therefore low, and the relatively coarse roots probably account for carbon-nitrogen ratios of 15 to 18 in the organic matter in comparison to less than 15 under annual grasses.

Soils in the transitional zone between areas of oak-grass and areas of coniferous forest have an A horizon that is somewhat thicker and higher in organic matter than that in soils at lower elevations. It seems likely that here changes in vegetation occurred because of fires or minor fluctuations in climate.

The coniferous forest is dominantly ponderosa pine, but it includes incense-cedar, white fir, Douglas-fir, and sugar pine. Red fir is common at elevations of more than 5,000 feet. Fresh and somewhat decomposed needles, leaves, and twigs form a mat from ½ inch to more than 6 inches thick on the surface of the soils. Such material is acid and contributes to the acidity of the soils. The roots of the trees follow cracks and fracture planes in the parent rock and help break up the rocks. Roots in the upper 2 or 3 feet of the soils, particularly those beneath and adjacent to the trees, make up more than 20 percent of the total volume in places, and their growth and decomposition make the soil more porous. In soils formed under forest, the carbon-nitrogen ratio exceeds 20. In some places shrubs are intermingled with the coniferous trees, generally where the soils are shallow or have been burned or cleared. In such areas the reestablishment of the tree canopy reduces the shrubs present.

Man has disturbed the soils in the Area through clearing, burning, and harvesting of timber, and through cultivation, grazing by livestock, and mining. Of these, mining has caused the greatest changes in the soils. In placer mining for gold, miners left about ten thousand acres of land in barren dredge piles or in mixed soil material that has only a fair potential for agriculture. In addition, prospect pits, mine dumps, and old mining ditches are in most areas.

Burning also has influenced the soils in many ways. Man and lightning are the main causes of fires. Repeated burning depletes organic matter and thus influences the characteristics of the surface soil. Fire changes plant ecology and different plant communities result. Thus, one of the soil-forming factors is altered.

Time

The age of soils is not necessarily related to the geologic age of the parent rock. Most of the geologic formations in the Area are very old. Only a fairly small acreage of soils adjacent to stream channels near the margin of the Great Valley is from recently deposited parent materials. In these places the soils are forming in alluvial sediments, and small areas receive fresh deposits of alluvium during local floods. In the majority of the soils, the length of time the parent material has been influenced by the weathering processes is more closely related to the erosion cycle. Thus areas in which erosion has proceeded at a slow rate have soils that have remained stable for a longer period of time.

Soils formed in material from consolidated or igneous parent materials most likely developed relatively slowly. In the middle of Pleistocene time the parent rock was uplifted through volcanic action, and, because of the steep gradients, the streams cut deeply into the underlying rock formations. During this period many of the slopes probably were of bare rock, and talus sediments were collecting along the lower slopes and in protected positions. As the streams became more deeply incised, their gradient was reduced and the adjacent slopes remained fairly constant instead of increasing in steepness.

The oldest soils probably formed at the foot of slopes in the talus that covered the bare rock and provided protection for growing plants. In time most of the slope had a thin cover of talus, and soils formed here also. Boulders of tuff breccia, which capped most of the mountain slope, are common in areas where even the crests of ridges are now granitic rock or metasedimentary rock. These boulders are relicts of the Mehrten formation that once covered the present land surface. Only after the surface was stabilized were soils formed in material derived through direct weathering of the underlying rocks. Where the gradient of the original land surface was low and the plain was not strongly dissected, the soils formed in material from the underlying rock. However, mechanical weathering rather than chemical weathering must have predominated, at least in the early stages of soil development.

The thickness of the soil developed on a particular slope is related to the rate that soil is lost through erosion

and the rate that the parent rock is weathered so that new soil forms. The rate of erosion is influenced mainly by (1) the steepness, shape, and length of slope; (2) the protective cover provided by vegetation; (3) the intensity, amount, and kind of precipitation, the rate of evaporation, and other climatic factors; (4) the rate that the soil absorbs and transmits water, either by percolation through the soil to the underlying rock, where it is removed along cracks in the rock or by seeping laterally down the slope through the soil; (5) the quantity of water the soil will retain; and (6) the resistance of the different kinds of parent material to erosion. Thus, the oldest soils in the Area are those on relatively undissected areas, and the youngest soils are those on very narrow steep divides, on very steep slopes, or other sites subject to erosion.

An example of the sequence of soil development in the Area is illustrated by the Maymen, Mariposa, Josephine, and Sites soils. The Maymen soils are on narrow ridge crests or adjacent steep slopes. These soils are very shallow or shallow over bedrock and lack a B2 horizon. The Mariposa soils are on broader divides and less erodible side slopes than the Maymen soils. They are moderately deep and have a weak B2t horizon. The Josephine soils are on long, stable slopes or on lower, gently sloping divides. They are moderately deep to deep, and they have a distinct, reddish B2t horizon. Sites soils are in the most stable positions in the landscape and have a B2t horizon of yellowish-red clay. Some of the differences in development of these soils, however, may be related to the ease of weatherability of the stratified parent rock.

The development of the Aiken, Cohasset, and McCarthy soils is similar. Aiken soils are on broad, old divides, and in places on stable side slopes. They have a very thick solum and a B2t horizon of reddish-brown to red clay. The Cohasset soils are on less stable slopes. Their B2t horizon is a clay loam, and the color is no redder than 5YR. The McCarthy soils are on steep, fairly unstable slopes. Their B2 horizon has higher chroma or redder hue than the A horizon, but it lacks clay films.

Morphology of Soils

Because the influence of the soil-forming factors varies greatly within the Area, many different kinds of soils have formed. Many soils in the Area have several prominent horizons; some have only one horizon, and others have several weak horizons. Soils with prominent horizons may occur adjacent to those with less distinct horizons, or they may be widely spaced in the landscape. The processes that have had the greatest influence in forming the different soil horizons are (1) weathering of parent materials, (2) accumulation of organic matter, (3) formation and translocation of clays, and (4) influence of iron oxides.

Some of the distinguishing features of the soils formed from bedrock are related to the degree of weathering of the parent material. For example, where weathering has been slight, the soils have few horizons and usually have distinguishing features that come from their parent material. The soils of the Pentz series are slightly weathered. They have few horizons, and their color and sandy texture are related to the underlying tuff. As weathering increases, horizon differences are less directly related to the parent material but are products of alteration. The deep Aiken soils have a red, fine-textured subsoil, and their horizons contrast strongly with the underlying brownish-yellow andesitic conglomerate.

In all soils of the Area, enough organic matter has accumulated on the surface to form an A1 horizon. These range from a thin, faint horizon, pale in color, to a thick, conspicuous horizon, dark in color. At the lowest elevations the soils have an A1 horizon that is about 4 to 8 inches thick and contains about 1 percent or less of organic matter. Because the temperature is warm in these places, large quantities of organic matter do not accumulate. At the highest elevations much cooler temperatures prevail. In these places are the Windy soils and other soils that have a thick, dark A horizon. Here the A horizon contains about 10 percent of organic matter in the upper 12 inches.

Many soils in the Area have horizons that differ in clay

TABLE 10.—*Laboratory analyses of*

[Analyses by Soil Survey

Soil name and sample number	Horizon	Depth	Size class and diameter of particles									
			Very coarse sand (2–1 mm.)	Coarse sand (1–0.5 mm.)	Medium sand (0.5–0.25 mm.)	Fine sand (0.25–0.10 mm.)	Very fine sand (0.10–0.05 mm.)	Silt (0.05–0.002 mm.)	Clay (less than 0.002 mm.)	0.2–0.02	0.02–0.002	Coarse fragments (greater than 2 mm.)
		Inches	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*
Ahwahnee loam (59 Calif. 3–17).	A1	0–9	7.8	13.5	6.0	12.5	10.8	39.4	10.0	38.8	19.1	2
	A3	9–16	8.7	13.1	5.8	12.2	11.0	38.7	10.0	36.0	21.3	2
	B2t	16–27	8.0	12.0	5.7	12.3	11.4	39.1	11.5	36.9	21.3	7
	B3t	27–32	7.7	12.5	5.2	12.1	11.2	40.3	11.0	35.8	20.2	1
	R	32–36+	Weathered granodiorite.									

content. These differences are caused by the formation and translocation of clay within the soil profile. Differences of clay content between the A and B2t horizons range from slight to more than 20 percent. In the Musick soils, for example, there is 20 percent more clay in the B2t horizon than in the A1.

Iron affects the color of many soils. In well-drained soils iron is likely to produce red and yellow colors. Where the iron has been translocated in the soil profile, the colors are more intense. The transfer of iron is greater in soils at elevations from 2,000 to 4,000 feet than at lower elevations. Here the temperatures favor a high degree of weathering and considerable water percolates through the soil. Forest litter on the surface produces organic acids that help to release iron for downward migration. For example, in the Musick soils there is about a 3 to 4 percent increase in free iron oxides from the A1 horizon to the B2t horizon. The increase is indicated by the redder color of the lower part of the soil profile.

Laboratory analyses

Soils from 14 of the principal soil series in the Amador Area were sampled for laboratory analyses. Each series was sampled at two places, but since the results were similar, data are presented for only one. The soil samples were air dried and crushed with a rolling pin so that the material would pass through a 2-millimeter, round-hole sieve. The gravel and stones larger than 2 millimeters in diameter were weighed to determine the percentage of gravel and were then discarded. The material that passed through a sieve was stored in a closed container for use in the laboratory analyses. Methods used in obtaining the data, which are given in table 10, are described in the paragraphs that follow. All results are expressed on an oven-dry basis.

Particle-size distribution was determined by the pipette method, with dispersion by sodium hexametaphosphate and by mechanical shaking, using the procedures developed by Kilmer, Alexander, and Mullins (*13*, *14*).

Bulk density was determined on samples that were taken in a steel tube containing 100 cubic centimeters.

Moisture retention at a tension of 15 atmospheres was determined by testing fragmented samples in pressure-membrane apparatus (*26*).

The reaction was determined by a Beckman Model H-2 meter. Twenty grams of soil were added to 20 milliliters of distilled water, stirred, and allowed to stand for 1 hour before a reading was made. The suspension was then filtered and the soil suspended in 20 milliliters of normal neutral potassium chloride and stirred; after 1 hour a reading was made. The electrodes were placed deep in the suspension immediately after the final stirring.

Cation-exchange capacity was determined by method 19 described in USDA Handbook No. 60 (*26*), except that 10 grams of soil were used. Aliquots were evaporated, and the ammonium acetate and organic matter removed with nitric acid and hydrochloric acid. Silica was dehydrated with 6*N* hydrochloric acid. Residue was dissolved in 0.4*N* hydrochloric acid, and sodium was determined by a Beckman flame-spectrophotometer. Extractable calcium, magnesium, hydrogen, sodium, and potassium were determined after extraction with neutral normal ammonium acetate according to the methods described by Peech and others (*19*). Twenty-five grams of soil were extracted with 250 milliliters of normal neutral ammonium acetate (pH 7). Calcium was precipitated as the oxalate and titrated with potassium permanganate; magnesium as ammonium magnesium phosphate, ignited and weighed as $Mg_2P_2O_7$. Separate aliquots of the ammonium acetate extract, for sodium and potassium determinations, were treated the same as the ammonium acetate extracts for cation-exchange capacity determinations. Sodium and potassium were analyzed in 0.4*N* hydrochloric acid by a Beckman flame-spectrophotometer.

The content of organic carbon was determined by the potassium dichromate and sulfuric acid heat of dilution method described in USDA Circular No. 757 (*19*). Soil was removed by filtration prior to titration with ferrous sulfate and ortho-phenanthroline as indicator. The organic carbon was calculated on the basis of 77 percent oxidation of organic matter. Total nitrogen was determined by the Kjeldahl method (*3*).

representative soils of Amador Area, Calif.

Laboratory, Riverside, Calif.]

Bulk density	Textural class	Moisture held at tension of 15 atmospheres	pH		Cation-exchange capacity (Na)	Extractable cations (meq. per 100 grams of soil)					Base saturation	Organic carbon	Total nitrogen	C/N ratio	Free iron oxide
			Water 1:1	KCl 1:1		Ca	Mg	H	Na	K					
Gm./cc.		*Percent*									*Percent*	*Percent*	*Percent*		*Percent*
1. 56	Loam and fine sandy loam.	5. 3	5. 8	4. 5	11. 3	5. 7	1. 4	3. 1	<0. 1	0. 2	66	0. 95	0. 077	12. 3	1. 1
1. 53	Loam and fine sandy loam.	5. 0	5. 7	4. 4	12. 0	7. 8	1. 4	2. 4	. 1	. 1	78	. 44	. 039	11. 3	1. 3
1. 56	Loam	6. 0	5. 8	4. 1	13. 9	7. 7	2. 2	1. 9	<. 1	. 1	84	. 27	. 028	9. 6	1. 2
1. 43	Loam	6. 3	5. 7	3. 9	17. 1	9. 7	3. 1	2. 6	<. 1	. 1	83	. 21	. 024	8. 8	1. 8

TABLE 10.—*Laboratory analyses of representative*

[Analyses by Soil Survey

Soil name and sample number	Horizon	Depth	Size class and diameter of particles									
			Very coarse sand (2–1 mm.)	Coarse sand (1–0.5 mm.)	Medium sand (0.5–0.25 mm.)	Fine sand (0.25–0.10 mm.)	Very fine sand (0.10–0.05 mm.)	Silt (0.05–0.002 mm.)	Clay (less than 0.002 mm.)	0.2–0.02	0.02–0.002	Coarse fragments (greater than 2 mm.)
			Inches	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*
Aiken loam (59 Calif. 3–11).[1]	A1	0–15	4.6	5.1	4.7	11.0	13.7	41.5	19.4	36.7	25.1	8.3
	A3	15–24	2.1	2.9	3.0	8.6	13.3	42.4	27.7	34.3	26.8	7.6
	B11t	24–37	1.7	3.4	2.7	7.7	11.7	40.7	32.1	31.8	25.4	7.3
	B12t	37–49	1.1	2.1	2.0	6.0	9.4	38.8	40.6	26.4	25.6	7.1
	B21t	49–59	1.9	2.1	1.6	5.1	8.9	37.4	43.0	23.3	26.2	7.6
	B22t	59–75	.8	1.4	1.7	5.1	8.2	27.0	45.8	21.5	26.9	19.3
	B31t	75–84	1.2	3.1	3.0	7.4	9.0	36.8	39.5	22.8	27.4	16.7
	B32t	84–92	1.5	3.0	2.8	7.2	9.4	37.3	38.8	23.3	27.8	37.1
Argonaut gravelly loam (59 Calif. 3–6).	A11	0–2	1.9	5.1	4.8	11.9	7.6	50.0	18.7	34.5	29.8	21
	A12	2–6	2.8	4.7	4.7	11.6	8.1	46.7	21.4	32.0	29.7	20
	B1t	6–10	2.2	4.3	4.4	11.2	8.2	44.9	24.8	31.6	28.1	15
	B21t	10–14	1.8	3.8	4.2	10.2	7.2	42.3	30.5	27.7	27.9	8
	B22t	14–21	1.7	3.2	3.3	7.5	5.5	29.6	49.2	19.4	20.3	22
	C1	21–27+	26.5	23.1	8.2	10.7	6.3	16.9	8.3	18.4	10.7	21
Auburn silt loam (59 Calif. 3–7).	A11	0–1½	2.5	4.4	3.4	6.7	5.9	63.4	13.7	31.5	41.9	14
	A12	1½–9	2.3	3.7	2.9	6.7	6.2	64.7	13.5	31.5	43.5	13
	B2t	9–14	2.6	4.3	2.7	6.1	6.2	64.1	14.0	32.1	42.2	13
	R	14–24+	Partly weathered schist.									
Fiddletown gravelly loam (60 Calif. 3–28).	A1	0–8	9.1	9.3	3.8	7.4	11.7	47.9	10.8	40.1	24.3	39
	B2	8–18	9.8	8.9	3.8	8.3	12.4	45.9	10.9	40.5	23.4	30
	B3	18–45	8.8	9.5	4.2	8.6	12.9	44.8	11.2	41.0	22.4	27
	R	45+	Grey somewhat fractured schist.									
Josephine gravelly loam (60 Calif. 3–24).	A1	0–2	4.8	6.9	3.2	11.2	12.7	47.5	13.7	39.7	28.5	33
	A3	2–9	3.6	6.0	2.8	10.8	13.6	47.6	15.6	40.8	28.2	11
	B1t	9–22	1.2	3.9	2.3	8.2	10.8	43.7	29.9	32.1	28.4	16
	B2t	22–37	1.2	4.0	2.3	5.9	6.1	42.1	38.4	22.1	30.0	8
	B3t	37–47	1.8	4.0	2.0	5.5	6.2	45.7	34.8	21.5	34.1	6
	R	47–68+	4.0	14.2	5.5	11.3	9.2	47.6	8.2	31.3	32.4	2
Mariposa gravelly loam (60 Calif. 3–25).	A11	0–1	3.9	5.7	4.4	10.4	11.5	55.5	8.6	43.5	29.9	20
	A12	1–4	3.2	5.2	4.1	8.9	11.6	55.7	11.3	41.3	31.7	12
	B1t	4–8	2.0	3.8	3.0	6.7	9.2	56.1	19.2	33.8	35.8	8
	B2t	8–15	.9	3.8	2.6	6.3	8.1	58.2	20.1	32.2	38.2	25
	B3t	15–23	1.0	3.2	2.1	5.5	7.2	64.6	16.4	31.1	44.3	9
	C1	23–36+	.7	3.5	3.1	7.7	9.0	67.5	8.5	38.3	43.1	11
Musick sandy loam (59 Calif. 3–13).	A1	0–9	4.7	15.0	11.1	18.3	9.6	26.8	14.5	32.0	14.8	3
	A3	9–20	3.5	14.0	9.9	17.2	10.3	27.6	17.5	32.2	15.3	0
	B1t	20–27	4.2	14.3	8.2	14.5	7.8	23.9	27.1	26.0	13.7	0
	B21t	27–39	3.5	13.5	8.0	15.7	7.6	16.0	35.7	24.9	7.6	0
	B22t	39–58	5.4	15.3	9.0	18.6	9.0	19.8	22.9	29.9	9.7	0
	B23t	58–78	5.6	10.9	5.9	13.1	8.2	24.3	32.0	27.2	13.2	0
	B3t	78–100+	11.8	18.6	8.9	19.2	10.4	21.3	9.8	33.4	9.4	0
Pardee gravelly loam (60 Calif. 3–22).	A11	0–2	4.6	17.7	6.9	9.5	5.5	44.3	11.5	28.5	26.7	22
	A12	2–9	6.3	15.7	6.9	9.5	6.3	44.3	11.0	29.9	26.2	26
	B21t	9–14	5.3	14.4	6.6	8.9	5.8	42.1	16.9	27.1	25.9	18
	B22t	14–17	7.1	14.1	7.0	9.0	5.9	39.3	17.2	26.4	24.5	33
	IIB23t	17–18	4.3	12.8	5.2	4.4	2.2	14.6	56.5	9.3	10.7	3
	IIC1	18–41+	11.4	39.7	11.5	6.2	2.8	10.2	18.2	8.6	7.5	57

See footnote at end of table.

soils of Amador Area, Calif.—Continued

Laboratory, Riverside, Calif.]

Bulk density	Textural class	Moisture held at tension of 15 atmospheres	pH		Cation-exchange capacity (Na)	Extractable cations (meq. per 100 grams of soil)					Base saturation	Organic carbon	Total nitrogen	C/N ratio	Free iron oxide
			Water 1:1	KCl 1:1		Ca	Mg	H	Na	K					
Gm./cc.		*Percent*									*Percent*	*Percent*	*Percent*		*Percent*
1.04	Loam	18.6	6.0	------	16.8	6.4	1.3	21.8	<.1	1.0	28	3.21	0.145	22.1	5.3
.95	Clay loam	19.0	5.8	------	11.9	5.1	.7	13.1	<.1	.7	33	.92	.044	21.0	6.1
1.05	Clay loam	19.6	5.8	------	12.0	4.8	.9	12.2	<.1	.7	34	.66	------	------	6.3
1.20	Clay	21.0	6.0	------	11.6	4.6	1.4	10.0	<.1	.6	40	.34	------	------	6.6
1.39	Clay	22.5	6.0	------	9.6	3.7	1.2	8.0	<.1	.6	41	.33	------	------	5.8
1.39	Clay	23.8	6.0	------	8.6	2.4	1.4	7.6	<.1	.5	36	.09	------	------	5.0
1.39	Clay loam and clay	22.4	6.0	------	7.5	2.0	1.0	6.2	<.1	.6	37	.09	------	------	5.0
1.31	Clay loam	22.8	6.0	------	6.8	2.0	1.3	6.6	<.1	.5	36	.08	------	------	5.2
------	Gravelly loam and gravelly silt loam.	10.7	6.1	4.8	23.9	10.3	7.0	7.3	.3	.3	71	2.21	.167	13.2	3.7
------	Gravelly loam	10.1	6.3	4.6	24.1	10.3	8.2	5.3	.1	.1	78	.67	.059	11.4	4.1
------	Gravelly loam	11.2	6.2	4.6	26.6	11.6	9.5	4.9	.1	.1	81	.47	.051	9.2	4.0
------	Clay loam	13.6	6.1	4.5	30.8	14.1	11.5	5.2	.1	.2	83	.43	.045	9.4	3.4
------	Gravelly clay	22.6	6.1	4.3	51.5	26.3	19.4	4.8	.4	.3	91	.25	.028	8.9	1.5
------	Gravelly coarse sandy loam.	8.8	7.1	3.5	------	------	------	------	------	------	------	.01	------	------	------
------	Silt loam	9.8	6.4	5.3	23.2	11.7	5.3	6.4	.1	.5	73	3.79	.247	15.3	2.5
------	Silt loam	7.0	6.4	4.8	19.6	9.3	5.0	5.1	.1	.1	74	1.18	.098	12.0	2.7
------	Silt loam	7.7	6.5	4.5	20.7	8.8	7.5	4.6	.1	.1	78	.42	.043	9.8	3.1
------	Gravelly loam	10.6	6.3	5.3	23.1	11.7	1.6	13.0	.2	.6	52	3.40	.215	15.8	3.8
------	Gravelly loam	9.6	6.2	5.2	18.5	8.1	.8	10.4	.1	.5	48	1.89	.133	14.2	4.1
------	Gravelly loam	8.9	6.3	5.2	13.8	5.7	.8	8.5	.1	.4	45	1.13	.084	13.5	4.0
------	Gravelly loam	10.5	6.0	4.9	23.9	9.1	2.9	14.7	.1	.5	46	4.22	.140	30.1	5.3
------	Loam	9.1	5.7	4.5	16.9	2.6	2.2	8.7	.1	.4	38	1.71	.068	25.1	5.8
------	Gravelly clay loam	13.7	5.1	4.1	11.7	.6	2.8	7.4	.1	.4	35	.75	.041	18.3	7.5
------	Silty clay loam and clay loam.	18.0	5.0	4.1	11.7	.4	2.7	8.2	.1	.3	30	.48	.028	17.1	10.4
------	Silty clay loam and clay loam.	17.0	5.0	3.9	11.4	.5	2.1	8.4	.1	.2	25	.31	.024	13.4	10.4
------	Loam	8.6	4.8	3.9	9.1	.3	1.5	6.1	.1	.1	24	.22	------	------	8.3
------	Gravelly silt loam	7.6	5.4	4.4	18.1	5.7	1.3	11.2	.1	.4	40	3.77	.131	28.8	2.5
1.30	Silt loam	6.9	5.6	4.4	11.4	2.7	.6	6.3	.1	.3	37	1.97	.063	31.3	2.7
1.35	Silt loam	9.7	5.3	4.0	11.2	1.6	.7	7.4	.1	.4	27	1.07	.052	20.6	2.9
1.33	Gravelly silt loam	10.0	5.0	3.6	10.8	.7	.5	7.4	.1	.2	17	.57	.031	18.4	2.8
1.44	Silt loam	9.2	4.8	3.3	13.4	.3	.6	10.3	.1	.1	10	.30	------	------	2.2
------	Silt loam	5.5	4.7	3.2	11.0	.4	.2	8.4	.1	.1	8	.07	------	------	1.3
1.09	Sandy loam	10.0	5.8	4.6	23.4	5.8	1.8	14.8	.2	.8	37	3.92	.152	25.8	2.2
1.22	Fine sandy loam	8.9	5.9	4.7	11.1	2.7	1.1	5.6	.1	.8	46	.50	.032	15.6	2.9
1.36	Sandy clay loam	12.9	5.8	4.9	11.7	3.0	1.3	5.6	.2	.9	49	.27	.019	14.2	4.3
1.43	Sandy clay and sandy clay loam.	16.2	6.0	5.5	11.7	3.3	1.3	4.5	.1	.8	55	.12	------	------	5.7
1.54	Sandy clay loam	12.7	5.8	5.2	10.4	1.9	1.0	4.2	.1	.8	48	.08	------	------	4.3
1.30	Clay loam	17.0	5.6	5.1	12.0	2.0	1.4	5.6	.2	.8	44	.13	------	------	5.4
1.31	Coarse sandy loam	8.7	5.4	4.2	8.6	.7	.6	3.8	<.1	.3	30	.04	------	------	3.5
------	Gravelly loam	8.7	5.6	4.9	17.7	9.5	1.5	8.9	.1	.6	57	3.70	.275	13.5	1.8
------	Gravelly loam	4.8	6.3	4.9	8.9	5.6	1.0	3.2	.1	.3	77	.51	.054	9.4	2.1
------	Gravelly loam	7.1	6.2	4.8	11.7	6.9	1.7	3.3	.1	.3	73	.32	.041	7.8	2.2
------	Gravelly loam	7.7	5.9	4.4	13.1	6.9	2.6	3.7	.2	.2	73	.24	.035	6.9	2.1
------	Clay	------	5.0	3.8	------	------	------	------	------	------	------	.48	.056	8.6	------
------	Gravelly coarse sandy loam.	16.4	5.4	4.1	28.1	17.2	9.1	3.9	.5	.2	87	.08	------	------	1.0

TABLE 10.—*Laboratory analyses of representative*

[Analyses by Soil Survey

Soil name and sample number	Horizon	Depth	Size class and diameter of particles									
			Very coarse sand (2–1 mm.)	Coarse sand (1–0.5 mm.)	Medium sand (0.5–0.25 mm.)	Fine sand (0.25–0.10 mm.)	Very fine sand (0.10–0.05 mm.)	Silt (0.05–0.002 mm.)	Clay (less than 0.002 mm.)	0.2–0.02	0.02–0.002	Coarse fragments (greater than 2 mm.)
			Inches	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*
Pentz sandy loam (60 Calif. 3–20).	A11	0–5	1. 9	13. 7	13. 4	27. 9	13. 2	21. 2	8. 7	40. 8	10. 0	0
	A12	5–10	1. 5	14. 7	13. 1	28. 4	13. 0	20. 6	8. 7	40. 0	10. 2	0
	C1	10–16	1. 9	13. 9	12. 4	27. 6	13. 3	21. 2	9. 7	40. 3	10. 5	1
	IIC2	16–28	5. 6	17. 2	11. 9	23. 1	13. 6	19. 2	9. 4	38. 0	8. 4	0
	IIC3	28–45	14. 5	21. 6	11. 7	20. 8	11. 8	15. 7	3. 0	33. 4	6. 0	0
Red Bluff gravelly loam (59 Calif. 3–9).	A11	0–3	4. 3	12. 3	10. 5	17. 5	7. 2	32. 2	16. 0	32. 4	16. 4	18
	A12	3–7	3. 9	11. 3	11. 1	18. 5	7. 9	29. 5	17. 8	34. 0	14. 0	17
	B1t	7–11	3. 0	10. 3	10. 2	16. 9	7. 0	27. 1	25. 5	30. 7	13. 1	10
	B21t	11–19	2. 2	5. 5	4. 5	7. 9	3. 9	17. 3	58. 7	15. 6	10. 7	3
	B22t	19–27	1. 3	4. 4	3. 9	7. 2	3. 6	17. 2	62. 4	15. 3	9. 7	2
	IIB3t	27–40	3. 8	6. 6	6. 4	11. 1	5. 1	19. 9	47. 1	20. 2	11. 2	26
Sierra coarse sandy loam (59 Calif. 3–15).	Ap	0–6	12. 1	14. 2	6. 2	12. 2	9. 7	33. 3	12. 3	33. 7	16. 7	3
	A3	6–15	11. 6	11. 7	5. 7	11. 2	9. 1	33. 0	11. 7	31. 6	17. 4	4
	B1t	15–24	10. 9	11. 6	5. 5	10. 8	9. 0	31. 7	20. 5	30. 4	16. 8	4
	B21t	24–33	6. 5	11. 6	5. 3	12. 0	9. 9	33. 7	21. 0	33. 9	16. 9	3
	B22t	33–45	8. 4	11. 7	5. 4	11. 7	10. 3	33. 3	19. 2	34. 0	16. 8	4
	B3t	45–66	9. 4	12. 5	5. 3	11. 8	10. 8	34. 9	15. 3	35. 0	18. 0	4
	C1	66–73	15. 6	16. 4	6. 4	12. 8	11. 1	29. 0	8. 7	34. 6	13. 2	5
Sites loam (59 Calif. 3–3).	Ap	0–8	2. 5	3. 4	2. 2	10. 1	14. 6	42. 8	24. 4	41. 2	24. 0	28
	A1	8–15	1. 4	2. 1	1. 7	9. 8	15. 3	42. 0	27. 7	42. 2	22. 8	28
	B11t	15–27	1. 3	2. 1	1. 4	8. 6	14. 5	43. 4	28. 7	43. 7	21. 1	27
	B12t	27–35	1. 5	2. 2	1. 4	8. 1	13. 8	40. 7	32. 3	40. 2	20. 8	35
	B21t	35–45	1. 4	1. 8	1. 0	6. 8	12. 5	34. 8	41. 7	36. 4	16. 5	32
	B22t	45–55	1. 5	1. 4	. 9	7. 0	12. 3	31. 6	45. 3	35. 0	14. 6	45
	B3t	55–67	1. 2	1. 6	1. 1	7. 4	13. 1	34. 5	41. 1	38. 8	14. 9	45
	C1	67–72	1. 8	2. 6	1. 5	10. 0	20. 5	45. 0	18. 6	57. 2	16. 3	40
Supan cobbly loam (59 Calif. 3–2).	Ap	0–8	. 7	2. 3	2. 8	9. 0	7. 9	49. 8	27. 7	30. 9	32. 3	11
	B11t	8–16	. 8	2. 0	2. 6	8. 6	7. 9	47. 1	31. 0	29. 5	31. 4	9
	B12t	16–22	. 6	2. 1	2. 8	8. 7	8. 0	45. 1	32. 7	29. 2	29. 7	17
	B2t	22–38	. 6	2. 9	3. 4	9. 4	7. 7	39. 2	36. 8	26. 9	26. 0	14
	B31t	38–58	1. 7	11. 7	9. 2	15. 3	8. 8	28. 8	24. 5	28. 2	18. 1	13
	B32t	58–70	1. 1	9. 5	8. 1	13. 0	8. 0	35. 2	25. 1	27. 1	23. 6	30
	R	70–75	3. 2	19. 1	12. 8	13. 5	7. 3	27. 5	16. 6	24. 4	17. 9	58
Windy cobbly sandy loam (561 Calif. 3–30).	A11	0–8	13. 0	18. 6	6. 1	12. 3	7. 7	33. 7	8. 6	25. 7	23. 0	18
	A12	8–16	12. 9	18. 7	6. 7	13. 3	7. 8	31. 2	9. 4	25. 0	21. 9	25
	AB	16–21	15. 8	19. 4	6. 4	12. 2	7. 4	29. 3	9. 5	24. 0	19. 6	9
	B2	21–35	11. 1	20. 7	8. 3	14. 6	7. 5	28. 7	9. 1	25. 5	19. 3	7
	C1	35–47	11. 9	22. 1	7. 6	13. 9	7. 5	29. 4	7. 6	24. 9	20. 1	6
	C2	47–57	17. 5	26. 7	8. 5	13. 6	6. 7	22. 6	4. 4	20. 0	16. 7	46
	R	57+	14. 9	25. 0	7. 3	11. 2	5. 8	31. 9	3. 9	19. 5	24. 3	13

[1] Cation-exchange capacity of these samples determined by direct distillation of NH_3 (*13*).

soils of Amador Area, Calif.—Continued

Laboratory, Riverside, Calif.]

Bulk density	Textural class	Moisture held at tension of 15 atmospheres	pH		Cation-exchange capacity (Na)	Extractable cations (meq. per 100 grams of soil)					Base saturation	Organic carbon	Total nitrogen	C/N ratio	Free iron oxide
			Water 1:1	KCl 1:1		Ca	Mg	H	Na	K					
Gm./cc		*Percent*									*Percent*	*Percent*	*Percent*		*Percent*
------	Fine sandy loam and sandy loam.	4. 4	6. 2	4. 9	9. 5	4. 2	1. 2	3. 7	0. 1	1. 0	64	0. 88	0. 077	11. 4	0. 7
------	Fine sandy loam and sandy loam.	4. 0	6. 1	4. 5	7. 9	3. 2	1. 0	3. 4	. 1	. 9	60	. 35	. 038	9. 2	. 5
------	Fine sandy loam and sandy loam.	4. 5	6. 0	4. 4	7. 1	3. 3	1. 3	2. 1	. 1	. 8	72	. 10	------	------	. 7
------	Sandy loam	6. 4	6. 0	4. 3	7. 3	2. 7	1. 8	1. 2	. 2	1. 2	83	. 07	------	------	. 5
------	Loamy coarse sand	6. 5	5. 2	3. 4	9. 0	. 9	2. 1	3. 0	. 5	2. 0	63	. 12	------	------	. 4
	Graveley loam and gravelly fine sandy loam.	9. 1	6. 5	5. 7	18. 4	11. 5	2. 3	5. 6	. 2	. 9	73	3. 58	. 248	14. 4	3. 1
------	Gravelly fine sandy loam.	6. 3	6. 1	5. 1	11. 8	5. 4	7. 9	4. 7	. 1	. 9	64.	1. 04	. 089	11. 1	3. 5
------	Fine sandy loam	8. 2	5. 3	4. 1	14. 4	4. 2	2. 5	6. 3	. 2	. 9	55	. 73	. 072	10. 1	3. 6
------	Clay	18. 9	4. 0	3. 2	26. 5	2. 8	3. 5	19. 3	. 1	. 8	27	. 54	. 065	8. 3	2. 8
------	Clay	21. 7	3. 6	2. 9	30. 3	2. 3	4. 0	23. 8	. 1	. 2	22	. 30	. 047	6. 4	2. 0
------	Gravelly clay	15. 3	3. 8	3. 0	22. 9	3. 0	2. 8	16. 8	. 1	. 2	27	. 19	------	------	3. 0
------	Coarse sandy loam	6. 3	6. 0	4. 9	10. 5	4. 7	1. 1	4. 5	. 1	. 5	59	1. 34	. 100	13. 4	1. 7
------	Loam	7. 8	5. 9	4. 6	9. 3	4. 5	1. 0	3. 5	<. 1	. 3	62	. 37	. 036	10. 3	2. 2
------	Loam	8. 8	6. 0	4. 6	10. 0	4. 3	1. 2	2. 7	. 1	. 3	69	. 17	. 021	8. 1	2. 5
------	Loam	9. 0	6. 2	4. 7	10. 3	4. 9	1. 5	2. 8	. 1	. 3	71	. 14	. 018	7. 8	2. 5
------	Loam	9. 1	6. 3	4. 8	11. 3	5. 6	1. 6	2. 5	. 1	. 3	75	. 09	. 014	6. 4	2. 6
------	Loam	9. 1	6. 5	4. 6	14. 8	8. 6	2. 9	2. 2	. 1	<. 1	84	. 07	------	------	2. 2
------	Coarse sandy loam	6. 6	6. 0	4. 3	14. 4	7. 5	8. 3	1. 9	. 1	. 1	89	. 04	------	------	1. 5
1. 13	Gravelly loam	13. 6	6. 3	5. 1	20. 2	6. 6	1. 1	11. 0	. 1	. 5	43	2. 43	. 120	20. 3	5. 2
1. 32	Gravelly clay loam	14. 2	6. 3	5. 1	16. 8	5. 2	. 8	9. 7	. 1	. 4	45	1. 22	. 074	16. 5	5. 3
1. 26	Gravelly clay loam	14. 0	6. 4	5. 2	14. 0	4. 5	1. 1	6. 3	. 2	. 5	50	. 63	. 045	14. 0	5. 9
1. 22	Gravelly clay loam	14. 5	6. 3	5. 1	14. 0	4. 0	1. 9	6. 6	. 2	. 2	49	. 47	. 036	13. 1	5. 9
1. 28	Gravelly clay	15. 9	6. 2	5. 2	12. 5	3. 5	2. 1	6. 2	. 2	. 2	49	. 30	. 028	10. 7	6. 4
------	Gravelly clay	16. 8	6. 2	5. 4	11. 9	3. 0	2. 3	5. 6	. 1	. 1	49	. 21	------	------	6. 9
1. 46	Gravelly clay	15. 5	6. 0	4. 9	9. 7	2. 5	1. 6	5. 8	. 2	. 1	43	. 18	------	------	6. 7
------	Gravelly loam	8. 0	5. 6	4. 3	6. 1	1. 2	1. 0	3. 7	. 1	. 1	37	. 15	------	------	4. 7
------	Clay loam and loam	14. 8	6. 3	5. 3	26. 0	16. 3	2. 0	7. 9	<. 1	1. 2	71	2. 50	. 215	11. 6	4. 7
------	Clay loam	15. 0	6. 5	5. 5	24. 3	15. 8	1. 5	6. 2	<. 1	1. 1	75	1. 23	. 113	10. 9	5. 0
------	Gravelly clay loam	15. 8	6. 8	5. 7	23. 4	15. 6	1. 5	5. 0	<. 1	1. 0	78	1. 00	. 092	10. 9	5. 0
------	Clay loam	18. 4	7. 3	6. 3	23. 4	15. 4	1. 6	3. 5	. 1	1. 6	84	. 38	. 052	7. 3	5. 1
------	Loam and sandy clay loam.	19. 5	7. 5	6. 6	25. 9	15. 3	3. 5	2. 8	<. 1	2. 4	88	. 25	. 035	7. 1	3. 8
------	Gravelly loam	18. 0	7. 2	6. 2	25. 5	11. 1	7. 0	3. 4	<. 1	1. 9	86	. 18	------	------	4. 1
------	Very gravelly clay loam.	16. 6	6. 9	5. 6	23. 0	8. 8	9. 1	3. 1	. 3	. 7	85	. 07	------	------	2. 4
------	Coarse sandy loam	18. 6	5. 9	4. 5	44. 1	5. 7	1. 2	25. 0	. 2	1. 0	25	6. 12	. 214	28. 7	1. 4
------	Coarse sandy loam	18. 3	5. 9	4. 6	40. 1	4. 1	. 8	25. 0	. 2	. 8	19	3. 87	. 174	22. 2	1. 1
------	Coarse sandy loam	15. 8	6. 0	4. 6	29. 6	4. 3	1. 1	18. 7	. 2	. 8	26	2. 18	. 091	24. 0	. 8
------	Coarse sandy loam	16. 0	6. 0	4. 5	26. 9	4. 6	2. 3	14. 8	. 2	1. 0	35	. 97	. 055	17. 6	. 4
------	Coarse sandy loam	16. 2	5. 9	4. 4	24. 5	2. 8	2. 2	15. 3	. 2	1. 0	29	. 90	. 051	17. 6	. 4
------	Coarse sandy loam	14. 5	6. 0	4. 2	24. 3	2. 7	1. 7	12. 8	. 2	1. 0	30	. 21	------	------	. 8
------	Coarse sandy loam	15. 1	6. 0	4. 0	28. 6	6. 2	3. 0	12. 9	. 2	. 8	44	. 11	------	------	. 5

Classification of Soils

In the system of soil classification followed in the United States since 1938 (*28*), soils are classified in six categories. These are the order, suborder, great soil group, family, series, and type. This system, with later modifications, has been followed to place soils of this Area in great soil groups. The modifications are those suggested by Thorp and Smith (*25*); Simonson, Riecken, and Smith (*23*); Oakes and Thorp (*18*); and Baur and Lyford (*4*).

The order, great soil group, series, and type are the categories that are used most. The classes in the highest category of the classification system are the azonal, intrazonal, and zonal orders. Each of these orders is represented by soils in the Amador Area.

Azonal soils lack development or are weakly developed, mainly because they are forming in recently deposited sediments, are derived from highly resistant materials, or are on steep slopes where runoff and removal of soil materials are rapid.

Intrazonal soils are well developed and reflect the dominant influence of some local factor of relief or parent material rather than of climate and biological factors.

Zonal soils formed through processes dominated by climate and biological forces. They are well developed and have formed from parent materials of mixed mineralogy that have been in place a long time and have not been subject to extreme conditions of relief.

The classification of soil series in the Amador Area into great soil groups is shown in the following tabulation.

Order and great soil group:	*Series*
Azonal—	
Alluvial soils	Honcut.
Lithosols	Exchequer, Iron Mountain, Maymen, Pentz.
Regosols	Laniger.
Intrazonal—	
Andolike soils	Fiddletown, McCarthy, Shaver, Windy.
Grumusols	Peters.
Sols Bruns Acides	Jiggs.
Zonal—	
Noncalcic Brown soils	Pardee, Perkins, Red Bluff, Ryer, Snelling.
Noncalcic Brown soils (Intergrading toward Brunizems).	Ahwahnee, Argonaut, Auburn, Henneke, Inks, Sierra, Supan.
Noncalcic Brown soils (intergrading toward Gray-Brown Podzolic soils).	Mokelumne.
Noncalcic Brown soils (intergrading toward Low-Humic Gley soils).	Shenandoah.
Reddish-Brown Lateritic soils.	Aiken, Cohasset, Holland, Josephine, Mariposa, Musick, Sites, Tiger Creek.

A representative profile of each soil series is described in the section "Descriptions of Soil Profiles." Laboratory data on samples of each horizon in the profiles of representative soils belonging to four of the great soil groups are given in the section "Laboratory Analyses."

The great soil groups represented in the Area are Alluvial soils, Lithosols, Regosols, Andolike soils, Grumusols, Sols Bruns Acides, Noncalcic Brown soils, and Reddish-Brown Lateritic soils. Discussions of each group follow.

Alluvial soils

Alluvial soils consist of recently deposited material that has not been in place long enough for soil horizons to develop. In places more recent deposits cover older soils. Many of the alluvial deposits in the Area are from mining activities.

The Honcut series is the only representative of this group in the Area, and soils of this series are not extensive. These soils consist of stratified, medium-textured alluvium that in many places overlies a buried, older soil at a depth of 45 inches. A small amount of organic matter has accumulated in the A horizon. Calcium is the dominant exchangeable cation, and base saturation is probably high.

Lithosols

Lithosols are shallow or very shallow over rock. Enough organic matter has accumulated to form a dark-colored A horizon, and this overlies a thin C horizon or hard rock. Lithosols are steep and erodible or overlie resistant rock that weathers slowly. Differences among soils in this group are mainly in texture, color, reaction, soil depth, and degree of fracture of the underlying bedrock, but there are probably also differences in mineralogy.

The Exchequer, Iron Mountain, Maymen, and Pentz soils are representative of Lithosols in this Area. Laboratory data for a Pentz soil is given in table 10.

Regosols

Regosols have faint horizons. The horizons show little difference in soil characteristics, except that the surface soil is thin and darker colored.

The soils of the Laniger series are the only Regosols in the Area, and they are not extensive. They developed under annual grasses and forbs in material from rhyolitic tuff and are medium acid to strongly acid. The tuff apparently weathers slowly, and the soils show little evidence of development.

Andolike soils

Andolike soils have an O horizon and a thick, dark, soft and porous A horizon. The B2 horizon has higher chroma, and in many places redder hue, than the A horizon. Generally, the soils have crumb or granular structure and are about medium acid.

The soils of the Fiddletown, McCarthy, Shaver, and Windy series are Andolike soils. Of these, the Fiddletown, McCarthy, and Windy soils contain some volcanic ash. Andolike soils are moderately deep or deep, and most of them contain appreciable numbers of cobblestones and other stones. The content of clay increases slightly in places with increasing depth, but clay films are absent. Base saturation is moderate to low, and the content of organic matter in the upper 12 inches ranges from about 4 to 10 percent. Kaolin or halloysite is the dominant clay mineral, but small or moderate amounts of gibbsite are also present. Laboratory data for a Fiddletown and a Windy soil are in table 10.

Grumusols

The only Grumusols mapped in the Area are soils of the Peters series. These soils are not extensive. They formed in material from andesitic tuff, which weathers readily to clay. The Grumusols are very dark gray, are granular in the upper part of the A horizon, and are fine textured throughout. These soils develop wide cracks on drying and have many slickensides in the lower part of the A horizon and in the upper part of the C horizon. Apparently granular material from the upper part of the A horizon falls down the cracks when the soil is dry, and when the subsoil is moistened the resulting increase in volume causes the soil to move. As a result, the lower part of the A horizon and the upper part of the C horizon are a mixture of material from both horizons.

Sols Bruns Acides

In the Sols Bruns Acides great soil group are soils of the Jiggs series. These soils are not extensive in the Area. Typically, Sols Bruns Acides have an O horizon, a thin A1 horizon, and a paler transitional horizon that grades to a B2 horizon, and they are strongly or very strongly acid. Except for a few thin clay films in pores in the B2 horizon, no appreciable translocation of clay is evident in the profile. The A1 horizon of these soils is granular, but the soils are otherwise massive.

Noncalcic Brown soils

Noncalcic Brown soils have a slightly acid, light pinkish-brown or light reddish-brown A horizon over a light reddish-brown or dull red B horizon. These soils formed under grass and forest in a subhumid wet-dry climate (*28*). Some of the Noncalcic Brown soils in the Amador Area, however, are brown or pale brown, particularly if they are not strongly weathered. Other than the typical Noncalcic Brown soils, there are in the area intergrades toward Brunizems, toward Gray-Brown Podzolic soils, and toward Low-Humic Gley soils.

The typical Noncalcic Brown soils are along the western margin of the Area, in the driest part, and extend into the Great Valley. These soils have a massive, brown A horizon that is low in organic matter and a redder, finer textured B2t horizon. The A horizon contains many very fine tubular and interstitial pores; it is hard or very hard when dry but is friable when moist. Where structure is evident in the B2t horizon, clay films generally are present on the faces of peds, though most of the clay appears to be in the tubular and interstitial pores. The soils are slightly or medium acid near the surface; they are more alkaline or remain constant in reaction with increasing depth. Horizon boundaries are indistinct except where the textural contrast between the A and B2t horizons is great or where the Bt horizon overlies relatively unweathered bedrock. The solum ranges in thickness from less than 1 foot where the soils are underlain by hard rock to more than 5 feet where the rock is deeply weathered or the parent material is unconsolidated.

The Pardee, Perkins, Red Bluff, Ryer, and Snelling are typical Noncalcic Brown soils. Representative of these are the Pardee and Red Bluff soils. Laboratory data for the Pardee soils (table 10), indicate that they formed in thin deposits of gravelly and cobbly alluvium. These deposits rest unconformably on andesitic tuff or other hard rock. The B2t horizon is weakly expressed because the alluvium is quartzitic and weathers slowly. The data also shows that the Red Bluff soils have a strongly developed B2t horizon of clay that is extremely acid. Red Bluff soils are infertile. About 35 percent of the clay minerals in the Pardee and Red Bluff soils is kaolin. The Red Bluff soils contain abundant montmorillonite, and the Pardee soils contain a moderate amount.

Noncalcic Brown soils that are intergrading toward Brunizems are in the Ahwahnee, Argonaut, Auburn, Henneke, Inks, Sierra, and Supan series. These soils differ from the typical Noncalcic Brown soils in having a darker A horizon that contains 1 to 2 percent of organic matter in the upper 6 to 10 or more inches. They occur in association with typical Noncalcic Brown soils or in areas of higher precipitation. Generally, the soils that are intergrading toward Brunizems are more fertile than the typical Noncalcic Brown soils, but the Henneke soils, which were derived from serpentine, are relatively infertile. The darker surface horizon of these soils may have been caused by the shrub vegetation under which they developed. Shrubs have coarse roots that decompose slowly.

Laboratory data for a profile of each of the Ahwahnee, Argonaut, Auburn, Sierra, and Supan series are given in table 10. The data indicate that the Ahwahnee and Auburn soils are very weakly developed and have only slightly more clay in the B2t horizon than in the A horizon. The presence of a few clay films in pores of these soils indicate that there has been some translocation of clay. The Auburn and Argonaut soils generally occur in association. The Auburn soils are well drained and are on the upper part of slopes. The Argonaut soils are on concave lower slopes, on saddles, or in slight depressions in areas where the bedrock is likely to trap water. The Argonaut soils have a clayey B2t horizon overlying bedrock. The seepage of water above the bedrock provides favorable moisture conditions for clay formation in those soils.

The Sierra soils are distinctly redder than the Ahwahnee and have a B2t horizon of loam or clay loam and A and C horizons of sandy loam. The Ahwahnee soils have less than 2.0 percent of free iron oxides, but the Sierra soils have about 2.5 to more than 4 percent of free iron oxides in the B2t horizon. In the Sierra soils continuous clay films in pores are thin to moderately thick, and much of the clay apparently has not moved very far. However, the clay films follow tubular pores and fracture planes in the parent rock in places, an indication that some translocation of clay occurs. The Ahwahnee and Sierra soils are nearly massive throughout and are slightly acid or medium acid. Their base saturation increases slightly with increasing depth.

The sample of the Supan soil for which data are given in table 10 was taken on a broad ridge underlain by cobbly, andesitic conglomerate. The Supan soils are apparently quite old. The profile is similar to that of the Sierra soils described, except that it lacks coarse sand, contains more clay throughout, and has chroma of 4 rather than 6.

The laboratory data indicate that montmorillonite and kaolin are present in the clay mineral fractions of each of the profiles sampled for the Ahwahnee, Argonaut, Sierra, and Supan series. The Auburn colloid is dominated by montmorillonite and has about 10 percent kaolin. The Sierra soils contain a small amount of montmorillonite, a moderate amount of both mica and mixed-layer mica-

vermiculite, and 20 to 30 percent kaolin. The Ahwahnee, Argonaut, and Supan soils have colloids with intermediate composition.

The soils of the Mokelumne series are the only Noncalcic Brown soils that intergrade toward Gray-Brown Podzolic soils. These soils are inextensive. Because of an A & B horizon and fairly low chroma and brown hue in the B2t horizon, the Mokelumne soils look like Gray-Brown Podzolic soils. The Mokelumne soils are very strongly acid, probably because their parent material is very acid. Also, these soils are infertile.

The only Noncalcic Brown soils that intergrade toward Low-Humic Gley soils are those of the Shenandoah series. These soils are moderately well drained to somewhat poorly drained. They differ from the typical Noncalcic Brown soils in having indistinct mottles at or near the surface and in being strongly or very strongly acid in the lower part of the A horizon.

Reddish-Brown Lateritic soils

The Reddish-Brown Lateritic soils have a dark reddish-brown, granular surface horizon, a red, friable clayey B horizon, and red, or reticulately mottled lateritic parent material. These soils formed under tropical forest in a humid, wet-dry climate (28).

The soils of the Aiken, Cohasset, Holland, Josephine, Mariposa, Musick, Sites, and Tiger Creek series are Reddish-Brown Lateritic soils. The Holland, Josephine, and Mariposa soils have an A1 horizon that is lighter colored than that of the other soils in this group, but none of the soils have an A2 horizon.

All of the Reddish-Brown Lateritic soils in the Area formed under conifers in a warm-temperate climate. They have an O horizon, ½ inch to 6 inches thick, of fresh and partly decomposed forest litter; a brown to reddish-brown, medium acid, granular A1 horizon that contains 2 to more than 5 percent of organic matter and has a carbon-nitrogen ratio of more than 20; and transitional A3 and B1 horizons that have less than 0.5 percent of organic matter in the lower part and generally have a few clay films in pores. Their B2t horizon is yellowish-red, reddish-yellow, red, or brown, weak blocky or massive loam to clay that generally has some clay films and is strongly acid. The B3 horizon grades to a C1 horizon or to parent rock. The solum ranges in thickness from about 3 to more than 10 feet. Clay films are generally most prominent in the B3t horizon. The reaction is slightly more acid with increasing depth.

Laboratory data for the Aiken, Josephine, Mariposa, Musick, and Sites soils are shown in table 10. In all of these profiles the sand has reddish-brown stains or coatings in the A horizon, which are distinctly fewer in the upper B2t horizon, and almost lacking in the B3 horizon. Hornblende, biotite, epidote, plagioclase feldspars, and other weatherable minerals are present in the sand. The sands of the Aiken and Cohasset soils are subrounded, and the soils contain many very fine pores. The sand fraction has about the same exchange capacity as the entire soil and apparently contains about the same kind and amount of clay minerals. The sand grains appear to be weathered fragments of parent rock.

The Tiger Creek soils differ from the other Reddish-Brown Lateritic soils in that they are about mildly alkaline throughout. These soils formed in impurities from marble or limestone. Some fragments of marble or limestone are on the surface and throughout the profile and keep the soils mildly alkaline. No lime is present in the soil between the rock fragments.

The total amount of organic matter contained in a volume of soil 1 meter below a square meter of mineral surface area is variable. The average content of organic matter for two profiles of each of five soil series is shown in the tabulation that follows; the amount of organic matter was adjusted for the amount of coarse fragments present.

Soil Series:	*Kilograms of organic matter per thousand cubic feet*
Aiken	28. 5
Musick	25. 2
Josephine	17. 5
Sites	14. 3
Mariposa	12. 0

The content of organic matter in the Cohasset, Holland, and Tiger Creek soils will probably range between those shown in the tabulation for the Aiken and Josephine soils. The figure for the Sites is low because one profile was sampled at a relatively low elevation and the other in a cultivated field. The Mariposa soils contain the least organic matter because the soils are shallow to moderately deep, have a relatively light-colored A horizon, and are on exposed ridges under an open stand of conifers, hardwoods, and shrubs.

The Aiken, Musick, Mariposa, Josephine, and Sites soils contain about 40 percent kaolin, a trace to as much as 20 percent of gibbsite, and a small amount of vermiculite. No montmorillonite is present.

Descriptions of Soil Profiles

Following are detailed descriptions of representative profiles of the different soil series in the Amador Area. The location of each profile is given. The letters and numbers on the left of the profile designate the horizons. Notations of color are shown by combinations of letters and numbers in parentheses, such as (10YR 5/4). In this example 10YR is the hue and 5/4 expresses the value and chroma. This notation is more precise than the name of the color, which is also given. Except where otherwise indicated, the notation is for dry soil. Technical terms are described in the "Soil Survey Manual" (*27*).

Ahwahnee loam: Near the crest of a hill on a slightly convex 5 percent slope facing northwest; under oaks, annual grasses, and forbs; elevation of 1,450 feet (SE¼ SE¼ sec. 31, T. 8 N., R. 11 E., on the Farnham Ranch; 0.5 mile from the junction of Votaw and Shenandoah Roads, on Votaw Road):

A1—0 to 9 inches, brown (10YR 5/3) loam near fine sandy loam, dark brown (10YR 3/3) when moist; massive; slightly hard when dry, friable when moist, nonsticky and slightly plastic when wet; abundant very fine roots; many very fine and fine pores and a few medium and coarse pores; medium acid (pH 5.8); clear, smooth boundary.

A3—9 to 16 inches, (10YR 5/3) loam near fine sandy loam, brown (10YR 4/3) when moist; massive; slightly hard when dry, friable when moist, slightly sticky and slightly plastic when wet; abundant very fine and fine roots and occasional medium and coarse roots; many very fine and fine pores and a few medium and coarse pores; medium acid (pH 5.7); clear, smooth boundary.

B2t—16 to 27 inches, brown (7.5YR 5/4) gritty loam, dark brown (7.5YR 4/4) when moist; massive; hard when dry, friable when moist, slightly sticky and plastic when wet; abundant very fine roots and a few fine, medium, and coarse roots; many very fine and fine pores and a few medium and coarse pores; a few thin, discontinuous clay films, mainly in bridges between sand grains; medium acid (pH 5.8); clear, wavy boundary.

B3t—27 to 32 inches, mixed light-brown (7.5YR 6/4), strong-brown (7.5YR 4/6), and pink (7.5YR 7/4) loam, reddish brown (5YR 4/4) and brown (7.5YR 5/4) when moist; massive with granitic appearance in place; hard when dry, friable when moist, slightly sticky and slightly plastic when wet; a few very fine to medium roots; common very fine and fine pores and a few medium and coarse pores; a few thin, discontinuous clay films in pores and old fracture planes; medium acid (pH 5.7); gradual, wavy boundary.

R—32 to 36 inches +, weathered granodiorite of color similar to that of the horizon above; a few clay films and roots along cleavage planes; medium acid (pH 5.8).

Aiken loam: On a slightly convex 8 percent slope facing west on a broad, gently sloping ridgetop; under a dense stand of ponderosa pine, incense-cedar, and black oak with an understory of sweet birch and bracken fern; elevation of 3,980 feet (0.12 miles northeast of the center of sec. 34, T. 8 N., R. 13 E., on the Allen Ranch; 2 miles west of the junction of Fiddletown-Silver Lake Road and State Highway No. 88, on the Fiddletown-Silver Lake Road):

O1—2 inches or less of organic material, consisting of fresh pine needles, leaves, and twigs, that is partly decomposed in the lower part.

A1—0 to 15 inches, reddish-brown (5YR 4/4) loam, dark reddish brown (5YR 3/3) when moist; strong, very fine and fine, granular structure; soft when dry, very friable when moist; abundant very fine, fine, and medium roots; many very fine and fine interstitial pores; common very fine and fine shot; slightly acid (pH 6.3); clear, smooth boundary.

A3—15 to 24 inches, reddish-brown (5YR 4/5) heavy loam, dark reddish brown (5YR 3/4) when moist; moderate, very fine and fine, granular structure; soft when dry, very friable when moist, slightly plastic when wet; abundant very fine and fine roots and a few medium and coarse roots; many very fine, fine, and medium pores and a few coarse pores; occasional thin, discontinuous clay films in pores; common very fine and fine shot; medium acid (pH 6.0); clear, smooth boundary.

B11t—24 to 37 inches, reddish-brown (5YR 4/5) clay loam, dark reddish brown (2.5YR 3/4) when moist; weak, very fine and fine, granular structure; slightly hard when dry, friable when moist, slightly plastic and sticky when wet; abundant very fine and fine roots and a few medium and coarse roots; a few thin, discontinuous clay films in pores; medium acid (pH 5.8); clear, wavy boundary.

B12t—37 to 49 inches, yellowish-red (5YR 4/6) heavy clay loam, dark red (2.5YR 3/6) when moist; massive; slightly hard when dry, firm when moist, slightly plastic and slightly sticky when wet; plentiful very fine and fine roots and a few medium and coarse roots; common very fine, fine, and medium pores and a few coarse pores; thin, continuous clay films in pores, and as bridges; common shot; medium acid (pH 5.8); clear, smooth boundary.

B21t—49 to 59 inches, yellowish-red (5YR 5/5) clay, reddish brown (2.5YR 4/5) when moist; massive; hard when dry, firm when moist, plastic and slightly sticky when wet; plentiful very fine roots and a few medium and coarse roots; a few very fine and fine pores and common medium pores; moderately thick, continuous clay films in pores and as bridges; common shot; medium acid (pH 6.0); gradual, smooth boundary.

B22t—59 to 75 inches, brown (7.5YR 5/5) clay, yellowish red (5YR 4/6) when moist; massive; very hard when dry, very firm when moist, plastic and slightly sticky when wet; a few roots; a few very fine, fine, and medium pores; moderately thick, continuous clay films in pores and as bridges; a few shot; medium acid (pH 6.0); gradual, smooth boundary.

B31t—75 to 84 inches, light-brown (7.5YR 6/4) clay, dark brown (7.5YR 4/4) when moist; massive; hard when dry, very firm when moist, plastic and slightly sticky when wet; a few roots and pores; thin, continuous clay films in pores; medium acid (pH 5.9); diffuse, smooth boundary.

B32t—84 to 92 inches, similar to the horizon above except light yellowish brown (10YR 6/4) when dry and pH may be slightly lower.

The shot in the profile have a porous reddish-brown coating on the surface. The matrix is generally the same color as the outer coating and is very finely porous, but in some places dark- and light-colored, less weathered mineral grains are present. A few shot appear to have crystalline cores that are weathering. Most of the sand grains and the coarser silt grains in the A horizon are coated and are nearly round. The B2t horizon contains as much as 10 percent of shot in places, but the crust seems to have partly exfoliated on some of these. The shot in the B2t horizon have thin clay films in the pores and appear to be weathering. In the B3t horizon the sand consists of uncoated, light- and dark-colored, weathering mineral grains. The shot and the dark uncoated mineral grains in the B horizons are all weakly attracted by a magnet. When the soil in the lower part of the profile is crushed, as much as half of the soil mass can be picked up with a small magnet.

Argonaut loam: On a slightly concave 6 percent slope facing southwest; under oaks, annual grasses, filaree, and sedges; elevation of 1,400 feet (0.15 mile northwest of the center of sec. 19, T. 6 N., R. 11 E.; 0.5 mile west of Martell on State Highway No. 88):

A11—0 to 2 inches, brown (7.5YR 5/4) loam, dark reddish brown (5YR 3/4) when moist; very weak platy structure; hard when dry, friable when moist; abundant very fine roots and a few fine and medium roots; many fine and very fine pores; slightly acid (pH 6.5); abrupt, smooth boundary.

A12—2 to 6 inches, yellowish-red (5YR 5/6) heavy loam, yellowish red (5YR 3/6) when moist; massive; hard when dry, friable when moist, nonsticky and slightly plastic when wet; plentiful very fine roots and a few fine and medium roots; many very fine and fine pores and a few medium pores; occasional thin, discontinuous clay films in pores; slightly acid (pH 6.5); clear, smooth boundary.

B1t—6 to 10 inches, yellowish-red (5YR 4/6) heavy clay loam, yellowish red (5YR 3/6) when moist; massive; hard when dry, friable when moist, slightly sticky and plastic when wet; roots and pores as in the horizon above; thin, discontinuous clay films in most pores; slightly acid (pH 6.5); clear, smooth boundary.

B21t—10 to 14 inches, similar to the horizon above but has clay texture and firm consistence, and clay films are thin and continuous in all pores; abrupt, wavy boundary.

B22t—14 to 21 inches, brown (10YR 5/3) clay with brown (7.5YR 5/4) coatings, yellowish brown (10YR 5/4) and brown (7.5YR 5/4) when moist; massive; very hard when dry, firm when moist, sticky and very plastic when wet; a few very fine to coarse roots; a few pores; thick, continuous clay films in pores; a few slickensides; slightly acid (pH 6.5); abrupt, wavy boundary; 4 to 7 inches thick.

C1—21 to 27 inches +, light yellowish-brown (2.5Y 6/4), deeply weathered meta-andesite with yellowish red (5YR 5/6), moderately thick, continuous clay films and occasional black (manganese?) stains along fracture planes; light olive brown (2.5Y 5/4), yellowish red (5YR 4/6), and black when moist; the weathered rock crumbles when disturbed but is firmer with increasing depth.

Auburn silt loam: On a smooth 10 percent slope facing east; under oaks, grasses, and scattered digger pines; elevation of 620 feet (0.25 mile north of the southeast corner of sec. 6, T. 6 N., R. 9 E., on the Josey Ranch; 3.5 miles northeast of Ione on State Highway No. 104, 0.15 mile west of the road):

A11—0 to 1½ inches, strong-brown (7.5YR 5/6) silt loam, reddish brown (5YR 4/4) when moist; massive; slightly hard when dry, friable when moist, slightly sticky and nonplastic when wet; abundant very fine roots; many very fine and fine pores; slightly acid (pH 6.4); clear, smooth boundary.

A12—1½ to 9 inches, yellowish-red (5YR 5/6) silt loam, reddish brown (5YR 4/4) when moist; massive; slightly hard when dry, friable when moist, slightly plastic when wet; abundant very fine, fine, and medium roots; many very fine, fine, and medium pores; a few thin, discontinuous clay films in pores; slightly acid (pH 6.4); gradual, smooth boundary.

B2t—9 to 14 inches, yellowish-red (5YR 5/8) silt loam, yellowish red (5YR 4/6) when moist; massive; slightly hard when dry, friable when moist, slightly sticky and slightly plastic when wet; roots and pores as in the horizon above; thin, continuous clay films in pores; slightly acid (pH 6.5); abrupt, slightly wavy boundary.

R—14 inches +, very pale brown (10YR 7/4) partly weathered amphibolite schist with reddish-brown (2.5YR 4/4) colloidal staining on fracture planes; a few roots in cracks; when moist can be scratched with fingernail; slightly acid (pH 6.5).

Cohasset loam: On a slightly convex slope of 24 percent facing south; under ponderosa pine, incense-cedar, and manzanita; elevation of 3,600 feet (0.2 mile southwest of the center of sec. 3, T. 7 N., R. 13 E., on the old Boscovich Ranch; 0.25 mile north of Ashland Creek):

O1 and O2—½ to 0 inch, primarily decomposed forest litter.

A11—0 to 2 inches, reddish-brown (5YR 5/3) loam, dark reddish brown (5YR 3/3) when moist; weak, fine, granular structure; soft when dry, friable when moist; abundant very fine roots; many very fine and fine pores; medium acid (pH 6.0); clear, smooth boundary.

A12—2 to 8 inches, reddish-brown (5YR 4/4) loam, dark reddish brown (5YR 3/4) when moist; weak, fine, granular structure; soft when dry, friable when moist; plentiful very fine roots and a few fine roots; many fine and very fine pores and a few medium pores; strongly acid (pH 5.5); a few thin, discontinuous clay films; clear, wavy boundary.

B1t—8 to 19 inches, yellowish-red (5YR 4/6) clay loam, dark reddish brown (5YR 3/4) when moist; massive; soft when dry, friable when moist, slightly sticky and slightly plastic when wet; plentiful fine roots and a few very fine, fine, medium, and coarse roots; common very fine, fine, and medium pores; strongly acid (pH 5.5); a few thin, continuous clay films in pores and coating sand grains; clear, wavy boundary.

B2t—19 to 27 inches, strong-brown (7.5YR 5/6) heavy clay loam, yellowish red (5YR 4/8) when moist; massive; slightly hard when dry, friable when moist, sticky and plastic when wet; a few fine, medium, and coarse roots; common very fine, fine, and medium pores and a few coarse pores; very strongly acid (pH 5.0); many moderately thick, continuous clay films in pores and adjacent areas and coating sand grains; clear, irregular boundary.

B31t—27 to 39 inches, reddish-yellow (7.5YR 6/8) very cobbly clay loam, strong brown (7.5YR 5/6) when moist; massive; slightly hard when dry, friable when moist, slightly sticky and slightly plastic when wet; a few fine, medium, and coarse roots that are less numerous than in the B2t horizon; common very fine, fine, and medium pores; very strongly acid (pH 4.5); a few thin, continuous clay films in pores and adjacent areas; gradual, broken boundary.

B32t—39 to 50 inches, white (10YR 8/2) loam with red specks, strong brown (7.5YR 5/6) when moist; mixed with weathered andesite; massive; slightly hard when dry, friable when moist, slightly sticky and slightly plastic when wet; a few fine and medium horizontal roots; many very fine, fine, and medium pores; very strongly acid (pH 4.5); a few thin, discontinuous clay films.

Cohasset sandy loam: On a slightly convex slope of 25 percent facing west; under ponderosa pine, incense-cedar, and white fir with an understory of mountain misery; elevation of 4,160 feet (0.13 mile northeast of the southwest corner of sec. 30, T. 8 N., R. 14 E.; 0.25 mile south-southwest of the Dew Drop Fire Control Station):

O1—4 to 0 inches of fresh and partly decomposed pine needles, leaves, and twigs that are more decomposed with increasing depth.

A11—0 to 11 inches, dark reddish-brown (5YR 3/3) sandy loam, dark reddish brown (5YR 2/3) when moist; strong, very fine and fine, granular structure; soft when dry and very friable when moist; abundant very fine, fine, and medium roots and a few coarse roots; many very fine and fine tubular and interstitial pores; medium acid (pH 6.0); clear, smooth boundary.

A12—11 to 21 inches, dark yellowish-red (5YR 2/4) sandy loam, dark reddish brown (5YR 3/4) when moist; strong, very fine and fine, granular structure; soft when dry and very friable when moist; abundant very fine, fine, and medium roots and a few coarse roots; many very fine and fine tubular and interstitial pores; medium acid (pH 5.8); clear, smooth to wavy boundary.

A8—21 to 30 inches, yellowish-red (5YR 4/8) loam, dark reddish brown (2.5 YR 3/4) when moist; strong, very fine and fine, granular structure; soft when dry, very friable when moist, slightly plastic when wet; abundant very fine, fine, and medium roots and a few coarse roots; a few very fine tubular pores and common fine and medium pores; strongly acid (pH 5.5); clear, wavy boundary.

B1t—30 to 40 inches, yellowish-red (5YR 4/8) heavy loam, dark red (2.5YR 3/6) when moist; moderate, fine, subangular blocky structure; soft when dry, friable when moist, slightly plastic and slightly sticky when wet; abundant very fine, fine, and medium roots and a few coarse roots; abundant very fine interstitial pores, a few very fine tubular pores, and plentiful fine and medium pores; very strongly acid (pH 5.0); a few thin clay films line tubular or interstitial pores; clear, wavy boundary.

B21t—40 to 57 inches, yellowish-red (5YR 4/8) clay loam, dark red (2.5YR 3/6) when moist; moderate, fine, subangular blocky structure; slightly hard when dry, friable when moist, sticky and slightly plastic when wet; plentiful very fine and fine roots and a few coarse and medium roots; many very fine interstitial pores, a few very fine tubular pores, and plentiful fine and medium pores; very strongly acid (pH 4.7); many moderately thick clay films on ped faces; gradual, wavy boundary.

B22t—57 to 65 inches, yellowish-red (5YR 5/6 to 5/8) clay loam, yellowish red (5YR 4/8) when moist; moderate, fine, subangular blocky structure; hard when dry, friable when moist, sticky and slightly plastic when wet; plentiful fine roots; many very fine and fine tubular pores; very strongly acid (pH 4.5, but pH 4.6 with bromcresol green); continuous, moderately thick clay films on ped faces; clear, smooth boundary.

B3t—65 to 74 inches, strong-brown (7.5YR 5/6) light clay loam, yellowish red (5YR 3/6) when moist; massive; hard when dry, friable when moist, slightly sticky and slightly plastic when wet; a few fine roots; common very fine pores and a few fine pores; many moderately thick clay films in tubular or interstitial pores; very strongly acid (pH 4.5, but pH 4.8 with bromcresol green); abrupt, wavy boundary.

C1—74 to 80 inches +, brownish-yellow (10YR 6/6) andesitic agglomerate with common, fine, distinct mottles of brownish yellow (10YR 6/8), strong brown (7.5YR 5/6) with common, fine, distinct mottles of reddish yellow (7.5YR 6/8) and strong brown (7.5YR 5/8) when moist; extremely firm when moist; a few fine roots; extremely acid (pH 4.4, but pH 5.0 with bromcresol green).

The hue at a depth between 21 and 65 inches is between 5YR and 2.5YR. There are a few cobblestones in this profile, and 15 percent of the B3t horizon consists of weathered, andesitic cobblestones ½ to 2 inches in diameter. The profile is slightly redder than in most Cohasset soils.

Exchequer silt loam: On a convex slope of 20 percent facing east; under chamise, other shrubs, and some grass; elevation of 650 feet (0.2 mile northeast of center of sec. 15, T. 5 N., R. 10 E.; 0.3 mile east of the Jackson Valley Spillway of the Pardee Reservoir):

A11—0 to 1½ inches, dark-brown (7.5YR 3/3) silt loam, dark brown (7.5YR 3/2) when moist; weak, fine granular structure; soft when dry, friable when moist, nonsticky and nonplastic when wet; a few very fine, fine, and coarse roots; many very fine and fine interstitial and tubular pores; slightly acid (pH 6.5); clear, smooth boundary.

A12—1½ to 6 inches, dark-brown (7.5YR 4/3) silt loam, dark brown (7.5YR 3/4) when moist; massive; slightly hard when dry, friable when moist, slightly sticky when wet; roots and pores same as in the horizon above; medium acid (pH 6.3); abrupt, irregular boundary.

R—6 inches +, pale-yellow (5Y 7/3) amphibolite schist with stains of dark reddish brown (2.5YR 3/4) and strong brown (7.5YR 5/6); schist is soft, laminated, and vertically tilted; medium acid (pH 6.0).

Exchequer loam: On a convex slope of 27 percent facing east; under chamise and other shrubs; elevation of 550 feet (0.25 mile southwest of the east quarter corner of sec. 21, T. 5 N., R. 10 E.; 0.3 mile west-northwest of Waters Peak):

O1—½ to 0 inch of matted, dry grass and oak leaves that are partly decomposed.

A1—0 to 7 inches, brown (10YR 5/3) loam, dark yellowish brown (10YR 3/4) when moist; massive, but breaks to weak, fine, granular structure; soft when dry, friable when moist, slightly sticky and slightly plastic when wet; abundant very fine and fine roots and a few coarse roots; common very fine and fine interstitial and tubular pores; slightly acid (pH 6.5); abrupt, irregular boundary.

R—7 inches +, light yellowish-brown (2.5Y 6/4) slate, light olive brown (2.5Y 5/4) when moist; slate is laminated, fine grained, and mostly in vertical beds.

Fiddletown gravelly loam: In the mid-portion of a 28 percent slope facing north; under black oak and incense-cedar; elevation of 1,980 feet (0.15 mile north of the south quarter corner of sec. 35, T. 8 N., R. 11 E.; 0.2 mile east of Fiddle Hill Ranch):

O1 and O2—2 to 0 inches of loose litter of oak leaves, pine needles, twigs, and other organic material that is partly decomposed in the lower part.

A1—0 to 8 inches, dark grayish-brown (10YR 4/2) gravelly loam, very dark brown (7.5YR 2/2) when moist; moderate, very fine, granular structure; soft when dry, friable when moist, slightly sticky and slightly plastic when wet; abundant very fine roots and a few fine to medium roots; many very fine interstitial and tubular pores and a few fine and medium tubular pores; slightly acid (pH 6.2); gradual, smooth boundary.

B2—8 to 18 inches, dark-brown (7.5YR 4/3) gravelly loam, very dark brown (7.5YR 2/2) when moist; 25 percent of the volume consists of pebbles, and about 15 percent of cobblestones and other stones; moderate, fine, granular structure; otherwise, material is similar to that of the A1 horizon; gradual, irregular boundary.

B3—18 to 45 inches, similar to the horizon above, except 80 percent of the volume is gravel, cobblestones, and other stones and rock outcrops; abrupt, irregular boundary.

R—45 inches +, gray (N 5/0) somewhat fractured schist, very dark gray (N 3/0) when moist; neutral (pH 7.0, ground rock).

Henneke gravelly loam: On the crest of a ridge in the lower foothills on a slightly convex 8 percent slope facing northwest; under a dense cover mainly of chamise but that includes scrub oaks, yerba santa, digger pines, grasses, and forbs; elevation of 1,050 feet (0.1 mile southeast of the north quarter corner of sec. 13, T. 5 N., R. 11 E.; 2 miles east of the Jackson Valley Spillway of Pardee Dam):

A1—0 to 4 inches, dark reddish-brown (5YR 3/4) gravelly loam, dark reddish brown (5YR 2/2) when moist; moderate, coarse granular structure; soft when dry, friable when moist, slightly plastic when wet; a few very fine and fine roots; many fine and very fine pores; slightly acid to neutral (pH 6.9); clear, irregular boundary.

B2t—4 to 9 inches, reddish-brown (5YR 4/4) gravelly clay loam, dark reddish-brown (5YR 3/4) when moist; weak, very fine, subangular blocky structure; soft when dry, friable when moist, plastic when wet; a few, very fine to medium roots; many fine and very fine pores; common thin clay films in some pores; slightly acid to neutral (pH 6.9); abrupt, irregular boundary.

R—9 inches +, gray, green, massive and hard serpentine rock.

Holland coarse sandy loam: On a 5 percent slope facing southeast; under conifers and shrubs; elevation of 1,900 feet; (0.2 mile southwest of the center of sec. 7, T. 7 N., R. 12 E., on the Molfino Ranch; 2.5 miles southwest of Pine Grove):

O1—2 to 0 inches of fresh and partly decomposed forest litter.

A1—0 to 4 inches, light brownish-gray (10YR 6/2) coarse sandy loam, very dark grayish brown (10YR 3/2) when moist; massive to very fine, granular structure; slightly hard when dry, friable when moist; abundant very fine roots; many very fine pores; slightly acid (pH 6.5); clear, smooth boundary.

A3—4 to 10 inches, brown (10YR 5/3) coarse sandy loam, dark grayish brown (10YR 4/2) when moist; massive to very fine, granular structure; slightly hard when dry, friable when moist; plentiful very fine roots and a few fine and coarse roots; many very fine pores and a few fine pores; slightly acid (pH 6.3); gradual, smooth boundary.

B1t—10 to 22 inches, light yellowish-brown (10YR 6/4) heavy coarse sandy loam, dark brown (10YR 4/3) when moist; massive; hard when dry, friable when moist, slightly sticky and slighty plastic when wet; a few very fine to coarse roots; many very fine pores and a few fine pores; medium acid (pH 6.0); a few thin, continuous clay films in pores; clear, smooth boundary.

B2t—22 to 38 inches, light yellowish-brown (10YR 6/4) coarse sandy clay loam, dark brown (7.5YR 4/4) when moist; massive; very hard when dry, firm when moist, slightly sticky and plastic when wet; a very few very fine to medium roots; many very fine pores and a few fine pores; medium acid (pH 6.0); common moderately thick, continuous clay films in most pores; gradual, smooth boundary.

B3t—38 to 49 inches, very pale brown (10YR 7/4) coarse sandy clay loam, light yellowish brown (10YR 6/4) when moist; massive; very hard when dry, friable when moist, slightly sticky and plastic when wet; a very few very fine to medium roots; many very fine pores; medium acid (pH 5.8); a few thin, continuous clay films in pores; diffuse, smooth boundary.

C1—49 to 58 inches, pale-yellow (2.5Y 7/4) light coarse sandy clay loam, pale yellow (2.5Y 7/4) when moist; massive; very hard when dry, friable when moist, slightly sticky and slightly plastic when wet; a very few very fine to medium roots; common very fine pores; medium acid (pH 5.6); gradual, smooth boundary.

C2/R—58 to 70 inches +, white (2.5Y 8/2) weathered granite, pale yellow (2.5Y 7/4) when moist; massive; hard when dry and firm when moist; strongly acid (pH 5.5); a very few thin, discontinuous clay films on ped faces.

The parent material is coarse crystalline granite that is high in light-colored feldspars and quartz but contains little of dark minerals.

Honcut very fine sandy loam: On a nearly level, low terrace in a field of alfalfa; elevation of 263 feet (0.4 mile southwest of State Highway No. 104 and 0.15 mile north of the southeast corner of sec. 15, T. 6 N., R. 9 E., 2.5 miles northwest of Ione):

AP—0 to 11 inches, brown to dark-brown (10YR 4/3) very fine sandy loam, dark brown (10YR 3/3) when moist; massive; slightly hard when dry, friable when moist, nonsticky and slightly plastic when wet; abundant very fine roots and a few fine roots; abundant very fine interstitial and tubular pores and a few fine tubular pores; slightly acid (pH 6.5); abrupt, smooth boundary.

C1—11 to 18 inches, yellowish-brown (10YR 5/4) very fine sandy loam, brown to dark brown (10YR 4/3) when moist; massive; weakly coherent when dry, friable when moist, nonsticky and nonplastic when wet; abundant very fine and a few fine roots; abundant very fine interstitial and tubular pores and a few fine tubular pores; stratified with silt lenses; slightly acid (pH 6.5); abrupt, smooth boundary.

C2—18 to 27 inches, yellowish-brown (10YR 5/4) very fine sandy loam, brown to dark brown (10YR 4/3) when moist; massive; weakly coherent when dry, friable when moist, nonsticky and nonplastic when wet; plentiful very fine roots and a few fine roots; abundant very fine interstitial and tubular pores and a few fine tubular pores; stratified with silt lenses; neutral (pH 6.7); abrupt, smooth boundary.

C3—27 to 36 inches, brown to dark-brown (10YR 4/3) silt loam, dark brown (7.5YR 3/2) when moist; massive; slightly hard when dry, friable when moist, slightly sticky and slightly plastic when wet; roots and pores same as in the horizon above; neutral (pH 7.2); gradual, smooth boundary.

A1b—36 to 45 inches, dark grayish-brown (10YR 4/2) silt loam, very dark brown (10YR 2/2) when moist; massive; hard when dry, friable when moist, slightly sticky and slightly plastic when wet; roots and pores same as in the horizon above; mildly alkaline (pH 7.5+); diffuse, smooth boundary.

B2b—45 to 60 inches, similar to the horizon above, but common thin clay films line tubular or interstitial pores.

Inks loam: In the foothills on a slightly concave slope facing north; under annual grasses, forbs, blue oaks, and live oaks; elevation of 500 feet (0.15 mile south of the east quarter corner of sec. 30, T. 5 N., R. 10 E.; 0.7 mile south-southeast of Buena Vista Peaks):

A11—0 to 3½ inches, brown (7.5YR 5/2) loam, dark brown (7.5YR 3/2) when moist; massive; slightly hard when dry, friable when moist, slightly sticky and nonplastic when wet; abundant very fine roots; many very fine pores; slightly acid (pH 6.3); a few fine shot; clear, smooth boundary.

A12—3½ to 7 inches, brown (7.5YR 5/2) loam, dark brown (7.5YR 3/2) when moist; massive; slightly hard when dry, friable when moist, slightly sticky and slightly plastic when wet; abundant very fine roots; many very fine pores and common fine pores; medium acid (pH 6.0); a few fine and medium shot; clear, smooth boundary.

A3—7 to 11 inches, brown to dark-brown (7.5YR 4/2) heavy loam, variegated dark brown (7.5YR 3/2) and grayish brown (2.5Y 5/2) when moist; moderate, medium, subangular blocky structure; hard when dry, friable when moist, slightly sticky and slightly plastic when wet; abundant very fine roots and a few fine and medium roots; many very fine pores and a few fine pores; medium acid (pH 6.0); a few medium and fine shot; gradual, smooth boundary.

B1t—11 to 18 inches, brown to dark-brown (7.5YR 4/2) clay loam, dark brown (7.5YR 3/2) when moist; moderate, medium, subangular blocky structure; hard when dry, friable when moist, sticky and plastic when wet; plentiful very fine roots and a few fine and medium roots; common very fine pores and a few fine and medium pores; a few thin clay films in pores and on ped faces; medium acid (pH 6.0); gradual, smooth boundary.

B2t—18 to 31 inches, brown to dark-brown (7.5YR 4/2) clay loam, dark brown (7.5YR 3/2) when moist; moderate, medium, subangular blocky structure; hard when dry, friable when moist, sticky and plastic when wet; a few very fine to medium roots; common very fine pores; many thin clay films, mainly in pores; medium acid (pH 6.0); abrupt, smooth boundary.

R—31 inches +, hard, massive, andesitic sandstone; olive brown (2.5Y 4/4) when moist with brown clay films on cracked surfaces; when crushed, is about coarse loamy sand in texture.

Iron Mountain loam: On a slightly concave 10 percent slope facing west; under oaks, digger pines, and shrubs; elevation of 1,360 feet (0.75 mile west of the northeast corner of sec. 2, T. 6 N., R. 10 E.; 2 miles west of the town of Sutter Creek):

A11—0 to 4 inches, dark grayish-brown (10YR 4/2) light loam, very dark brown (10YR 2/2) when moist; weak, medium, subangular blocky structure that breaks to weak, medium, granular; soft when dry, friable when moist, nonsticky and nonplastic when wet; abundant very fine and fine roots; many very fine interstitial and tubular pores; medium acid (pH 5.8); clear, smooth boundary.

A12—4 to 20 inches, dark grayish-brown (10YR 4/2) light loam, very dark brown (10YR 2/2) when moist; weak, medium, subangular blocky structure that breaks to weak, medium, granular; soft when dry, friable when moist, nonsticky and nonplastic when wet; abundant very fine and a few medium and coarse horizontal roots; many very fine interstitial and tubular pores and common fine interstitial and tubular pores; strongly acid (pH 5.3); abrupt, smooth boundary.

R—20 inches +, very pale brown (10YR 7/3) very hard, tuffaceous, andesitic material with flecks of white (10YR 8/1), light red (2.5YR 6/8), and brown (10YR 4/3) when moist; cemented with cobblestones and other stones and partly weathered in the upper part of the horizon.

Jiggs very rocky loam, 16 to 51 percent slopes: On a 30 percent slope facing north; under shrubs; elevation of 2,120 feet (0.15 mile northeast of the east quarter corner of sec. 2, T. 7 N., R. 11 E.; 1 mile southeast of Fiddletown):

A1—0 to 7 inches, grayish-brown (10YR 5/2) gravelly loam, dark brown (10YR 2/2) when moist; moderate, medium, fine granular structure; slightly hard when dry, friable when moist, slightly sticky and slightly plastic when wet; abundant very fine roots and a few fine roots; many very fine tubular and interstitial pores; medium acid (pH 6.0); abrupt, smooth boundary.

B1—7 to 18 inches, light yellowish-brown (10YR 6/4) cobbly loam, dark brown (7.5YR 3/4) when moist; massive; slightly hard when dry, friable when moist, slightly sticky and slightly plastic when wet; plentiful very fine roots and a few fine and medium roots; many very fine interstitial and tubular pores and a few fine interstitial and tubular pores; medium acid (pH 5.6); clear, smooth boundary.

B2—18 to 29 inches, brown (10YR 5/3) cobbly heavy loam, dark yellowish brown (7.5YR 4/4) when moist; massive; hard when dry, slightly firm when moist, sticky and slightly plastic when wet; plentiful very fine pores and a few fine and medium pores; many very fine tubular pores; a few thin clay films in pores; strongly acid (pH 5.1); gradual, smooth boundary.

B3—29 to 48 inches, light-gray (10YR 7/2) very cobbly light loam, grayish brown (10YR 5/2) when moist; massive; slightly hard when dry, friable when moist, slightly

sticky and slightly plastic when wet; a few fine roots; common very fine pores; strongly acid (pH 5.1); clear, irregular boundary.

R—48 inches +, white (10YR 8/1) hard, fractured, rhyolitic tuff; pockets partly filled with soil material similar to that in the horizon above; in some places roots extend into cleavages.

Josephine gravelly loam: On a 25 percent slope facing north; under ponderosa pine, black oak, and mountain misery and other shrubs; elevation of 2,050 feet (0.35 mile north of the southeast corner of sec. 24, T. 7 N., R. 11 E.; 0.5 mile west of where Shake Ridge Road crosses the Rancheria Creek):

O1—1 to 0 inch of fresh pine needles and litter and of decomposing litter.

A1—0 to 2 inches, brown (10YR 4/3) gravelly loam, dark brown (7.5YR 3/2) when moist; weak, fine, subangular blocky structure; slightly hard when dry, friable when moist, slightly sticky and slightly plastic when wet; abundant very fine roots and a few fine and medium roots; many very fine interstitial and tubular pores and a few fine interstitial and tubular pores; slightly acid (pH 6.5); abrupt, smooth boundary.

A3—2 to 9 inches, brown (7.5YR 5/4) loam, dark brown (7.5YR 4/4) when moist; slightly hard when dry, friable when moist, slightly sticky and slightly plastic when wet; abundant very fine roots and a few fine and medium roots; many very fine tubular and interstitial pores and a few fine and medium tubular pores; medium acid (pH 6.0); clear, smooth boundary.

B1t—9 to 22 inches, brown (7.5YR 5/5) gravelly clay loam, reddish brown (5YR 4/5) when moist; moderate, medium, subangular blocky structure; hard when dry, friable when moist, sticky and plastic when wet; abundant very fine roots and a few fine to very coarse roots; pores similar to those in the horizon above; thin, nearly continuous clay films in pores; strongly acid (pH 5.3); gradual, irregular boundary because of a few partly disintegrated stones and bedrock.

B2t—22 to 37 inches, brown (7.5YR 5/5) silty clay loam, strong brown (7.5YR 4/6) when moist; moderate, medium, subangular blocky structure; very hard when dry, firm when moist, sticky and plastic when wet; a few fine to coarse roots; many very fine interstitial and tubular pores and a few fine and medium tubular pores; moderately thick, continuous clay films on ped faces and in many pores; about 25 percent of horizon is rottenstone; strongly acid (pH 5.3); gradual, irregular boundary.

B3t—37 to 47 inches, yellowish-brown (10YR 5/6) silty clay loam, dark yellowish brown (10YR 4/6) when moist; moderate, medium, subangular blocky structure; very hard when dry, firm when moist, slightly sticky and slightly plastic when wet; a few very fine to large roots; many very fine interstitial pores; a few very fine tubular pores and common fine tubular pores; clay films similar to those in the horizon above, but thin; about 35 percent of the horizon is rottenstone; very strongly acid (pH 4.9); clear, irregular boundary.

C1—47 to 68 inches, brownish-yellow (10YR 6/6), yellowish-red (5YR 5/6), and gray (N 6/0) decomposing rock, brownish yellow (10YR 6/6), red (2.5YR 4/6), and dark gray (N 4/0) when moist; massive; extremely hard when dry, very firm when moist; a few roots; a few very fine tubular pores and common fine interstitial pores; moderately thick, continuous clay films along fracture faces.

Laniger sandy loam, 2 to 16 percent slopes: On a slightly concave 10 percent slope facing west; under oaks, digger pines, and shrubs; (0.2 mile northwest of the southeast corner of sec. 9, T. 5 N., R. 9 E.; 0.6 mile southwest of the Jackson Creek bridge on State Highway No. 88 on the Orr Ranch):

A11—0 to 2 inches, pale-brown (10YR 6/3) sandy loam, dark brown (10YR 3/3) when moist; massive, but breaks to weak, medium, platy structure; soft when dry, very friable when moist; abundant very fine and fine roots; many very fine and fine tubular and interstitial pores and a few medium and coarse tubular and interstitial pores; medium acid (pH 6.0); gradual, smooth boundary.

A12—2 to 12 inches, light yellowish-brown (10YR 6/4) sandy loam, brown to dark brown (10YR 4/3) when moist with variegations of brown (10YR 5/3); massive; consistence, roots, and pores similar to horizon above; strongly acid (pH 5.8); clear, wavy boundary.

C1—12 to 28 inches, similar to horizon above, but color when moist is brown (10YR 5/3) with variegations of dark brown (10YR 4/3) and yellowish brown (10YR 5/6); roots are fewer, and texture appears to have a higher coarse sand fraction; abrupt, wavy boundary.

C2—28 to 34 inches, light-gray (10YR 7/2) coarse sandy loam, pale brown (10YR 6/3) with streaks of yellowish brown (10YR 5/6) when moist; structure, consistence, and pores, same as in horizon above; a few very fine and fine roots; strongly acid (pH 5.1); abrupt, wavy boundary.

R—34 inches +, light-gray to white (10YR 7/2 to 8/1) weathered, rhyolitic tuff with some black managanese stains on fracture faces; roots tend to flatten out on the upper boundary.

Mariposa gravelly loam: Near a ridge crest on a 7 percent slope facing south; under manzanita, ponderosa pine, and black oak; elevation of 2,900 feet (0.2 mile east-southeast of the center of sec. 34, T. 8 N., R. 13 E.; 3.5 miles west of the junction of the Fiddletown-Silver Lake Road and the Shake Ridge Road):

O1—1½ to 0 inches of loose manzanita leaves, oak leaves, and pine needles; partly decomposed in the lower part.

A11—0 to 1 inch, pale-brown (10YR 6/3) gravelly silt loam, dark brown (7YR 4/3) when moist; massive; soft when dry, friable when moist, slightly sticky and slightly plastic when wet; plentiful very fine roots; many very fine interstitial and tubular pores and a few fine tubular pores; medium acid (pH 6.0); abrupt, smooth boundary.

A12—1 to 4 inches, yellowish-brown (10YR 6/4) silt loam, dark brown (7.5YR 4/4) when moist; massive; soft when dry, friable when moist, slightly sticky and slightly plastic when wet; plentiful very fine roots and a few fine roots; many very fine interstitial and tubular pores and a few fine tubular pores; medium acid (pH 6.0); abrupt, smooth boundary.

B1t—4 to 8 inches, pink (7YR 7/4) silt loam, yellowish red (5YR 5/6) when moist; massive; slightly hard when dry, firm when moist, slightly sticky and plastic when wet; plentiful very fine and fine roots and a few medium and coarse roots; many very fine interstitial and tubular pores and a few fine and medium tubular pores; thin, discontinuous clay films in some pores; strongly acid (pH 5.5); gradual, smooth boundary.

B2t—8 to 15 inches, similar to horizon above, except texture is light silty clay loam; a few very fine and fine roots; common very fine and a few fine tubular pores; thin, continuous clay films in pores; gradual, smooth boundary.

B3t—15 to 23 inches, pink (7.5YR 7/4) silt loam, reddish yellow (5YR 6/6) when moist; massive; slightly hard when dry, firm when moist, slightly sticky and slightly plastic when wet; occasional roots; common very fine and a very few fine tubular pores; thin, continuous clay films in a few pores; strongly acid (pH 5.5); clear, somewhat irregular boundary.

C1—23 to 36 inches, very pale brown (10YR 7/3) decomposing schist with strong brown (7.5YR 5/6) stains along fracture planes, light brownish gray (10YR 6/2) and strong brown (7.5YR 5/6) when moist; some vertical strata are firm or very firm, others are extremely firm or rocklike; a few roots; a few fracture planes evident; very strongly acid (pH 5.0, ground rock).

The angular fractured fragments contain many concretions of iron and manganese. Also, krotovinas are evident.

Maymen very rocky loam: On a convex 52 percent slope facing south; under annual grasses and forbs (shrubs apparently cleared); elevation of 1,250 feet (0.19 mile south-southeast of the west quarter corner of sec. 29, T. 7 N., R. 11 E.; 1.5 miles east-northeast of Amador City):

A1—0 to 7 inches, dark grayish-brown (10YR 4/2) very rocky loam, very dark brown (10YR 2/2) when moist; weak, fine, granular structure; soft when dry, friable when moist, slightly sticky and slightly plastic when wet; abundant very fine roots; many very fine interstitial pores; medium acid (pH 6.0); abrupt, irregular boundary.

R—7 inches +, black, fine-grained, tilted, slate rock.

McCarthy very cobbly loam: On a 4 percent slope facing south; under ponderosa pines, oaks, and shrubs; elevation of 3,220 feet (center of sec. 28, T. 7 N., R. 11 E.; 2.5 miles east-northeast of Amador City):

A11—0 to 7 inches, dark grayish-brown (10YR 4/2) very cobbly loam, very dark brown (10YR 2/2) when moist; moderate, very fine, granular structure; soft when dry, very friable when moist, nonsticky and nonplastic when wet; abundant very fine roots; many very fine interstitial pores; medium acid (pH 6.0); about 5 percent of this horizon is cobblestones; diffuse, smooth boundary.

A12—7 to 21 inches, color and texture same as in horizon above; weak, very fine, granular structure; soft when dry, friable when moist, nonsticky and nonplastic when wet; roots same as in horizon above; common very fine tubular pores and many very fine interstitial pores; pH same as in horizon above; about 15 percent of this horizon is cobblestones; diffuse, smooth, boundary.

B2—21 to 31 inches, same as in horizon above, except that the hue of this horizon is somewhat redder, about 40 percent is cobblestones, and the boundary is diffuse and slightly irregular.

R—31 inches +, brownish-yellow (10YR 7/2) weathered breccia; (pH 6.0).

Mokelumne sandy loam: On a gentle 5 percent slope facing south; under annual grasses, forbs, and blue oaks; elevation of 250 feet (0.25 mile northeast of the center of sec. 16, T. 6 N., R. 9 E.; 0.2 mile southwest of the Edwin siding on State Highway No. 104):

A11—0 to 1 inch, grayish-brown (10YR 5/2) sandy loam, very dark grayish brown (10YR 3/2) when moist; weak, medium, platy structure; soft when dry, friable when moist, nonsticky and nonplastic when wet; abundant very fine roots; many very fine pores; medium acid (pH 6.0); abrupt, smooth boundary.

A12—1 to 13 inches, brown (7.5YR 5/3) sandy loam, reddish brown (5YR 4/4) when moist; massive; slightly hard when dry, friable when moist, nonsticky and nonplastic when wet; plentiful very fine roots; many very fine tubular pores; very strongly acid (pH 4.8); a few quartz pebbles and cobblestones; abrupt, irregular boundary.

A&B—13 to 14 inches, light-gray (10YR 7/2) sandy clay loam, yellowish brown (10YR 5/4) when moist; massive; hard when dry, friable when moist, sticky and plastic when wet; plentiful very fine roots; many very fine tubular pores; in places common moderately thick clay films in pores; strongly acid (pH 4.8); abrupt, irregular boundary.

B2t—14 to 22 inches, pale-brown (10YR 6/3) sandy clay with brown (10YR 5/3) coatings, light olive brown (2.5Y 5/4) with brown (10YR 5/3) coatings when moist; strong, coarse, columnar structure; very hard when dry, very firm when moist, sticky and plastic when wet; a few very fine roots; common very fine interstitial and tubular pores; continuous, thick clay films on ped faces and in pores; very strongly acid (pH 4.5); diffuse, smooth boundary.

B3t—22 to 39 inches, light-gray (2.5Y 7/2) coarse sandy clay loam with pale brown (10YR 6/3) coatings; light olive brown (2.5Y 5/4) when moist with brown (10YR 5/3) coatings; moderate, coarse, prismatic structure; very hard when dry, very firm when moist, sticky and plastic when wet; a few very fine roots; common very fine tubular pores and many very fine interstitial pores; continuous, thick clay films in pores and common moderately thick clay films on ped faces; very strongly acid (pH 4.5); diffuse, smooth boundary.

C1—39 to 52 inches +, white (5Y 8/2) coarse sandy clay loam) pale olive (5Y 6/3) when moist; massive; very hard when dry, extremely firm when moist, sticky and plastic when wet; many very fine interstitial pores; many thick clay films in pores; very strongly acid (pH 4.5).

Musick sandy loam: On a convex 12 percent slope facing north; under ponderosa pines, black oaks, and live oaks; elevation of 2,680 feet (Stout Realty lot 6, subdivision next to the McFadden fence, NE¼NW¼ sec. 1, T. 6 N., R. 12 E.; 0.5 mile south of the junction of State Highway No. 88 and West Point Road):

O1—2 inches or less of a fresh litter of pine needles and leaves that is partly decomposed in the lower part.

A1—0 to 9 inches, brown (7.5YR 4/3) sandy loam, dark brown (7.5YR 3/3) when moist; moderate, fine and very fine, granular structure; soft, although slightly hard in the upper 4 inches when dry, friable when moist; abundant very fine and fine roots and a few medium and coarse roots; many very fine, medium, and coarse pores; a few very fine and fine shot (essentially nonmagnetic); medium acid (pH 5.8); clear, smooth boundary.

A3—9 to 20 inches, yellowish-red (5YR 5/5) fine sandy loam, reddish brown (5YR 4/4) when moist; massive; slightly hard when dry, friable when moist, nonsticky and slightly plastic when wet; roots and pores as in the horizon above; thin, discontinuous clay films in pores; a few very fine shot; medium acid (pH 5.9); gradual, smooth boundary.

B1t—20 to 27 inches, yellowish-red (5YR 5/6) sandy clay loam, yellowish red (5YR 4/6) when moist; similar to horizon above, except that clay films are thin and continuous in pores; gradual, smooth boundary.

B21t—27 to 39 inches, yellowish-red (5YR 5/6) sandy clay near sandy clay loam, red (2.5YR 4/6) when moist; massive; hard when dry, firm when moist, slightly sticky and slightly plastic when wet; plentiful very fine, fine, and medium roots and a few coarse roots; many very fine, fine, and medium pores and a few coarse pores; moderately thick, continuous clay films in pores and as bridges and moderately thick clay films in some pores; medium acid (pH 6.0); gradual, smooth boundary.

B22t—39 to 58 inches, yellowish-red (5YR 5/6) sandy clay loam, red (2.5YR 4/6) when moist; similar to the horizon above, except that roots and pores are fewer, clay films are thinner, and the pH is 5.8; gradual, smooth boundary.

B23t—58 to 78 inches, yellowish-red (5YR 5/8) clay loam, red (2.5YR 4/6) when moist; massive; slightly hard when dry, firm when moist, slightly plastic and slightly sticky when wet; a few very fine, fine, and medium roots; many very fine and fine pores and a few medium and coarse pores; thin, continuous clay films in pores and as bridges and moderately thick clay films in some pores; medium acid (pH 5.6); gradual, smooth boundary.

B3t—78 to 100 inches +, reddish-yellow (5YR 6/7) coarse sandy loam, yellowish red (5YR 5/8) when moist; massive; soft when dry, firm when moist, slightly plastic and nonsticky when wet; a few very fine to medium roots and pores; thin, continuous clay films in most pores; strongly acid (pH 5.4).

Pardee cobbly loam: On a slightly hummocky terrace on a 4 percent slope facing west; under annual grasses and scattered oaks; elevation of 550 feet (0.1 mile north of the

southeast corner of sec. 25, T. 5 N., R. 9 E.; 1.6 miles southwest of Buena Vista Peaks):

A11—0 to 2 inches, brown (7.5YR 4.5/3) gravelly loam, dark brown (7.5YR 3/4) when moist; massive; slightly hard when dry, friable when moist, slightly sticky and slightly plastic when wet; abundant very fine roots; many very fine interstitial and tubular pores; slightly acid (pH 6.1); abrupt, smooth boundary.

A12—2 to 9 inches, brown (7.5YR 5/3.5) gravelly loam that is about 15 percent cobblestones, dark brown (7.5YR 3/4) when moist; massive; hard when dry, friable when moist, slightly sticky and slightly plastic when wet; abundant very fine roots; many very fine pores; slightly acid (pH 6.3); gradual, smooth boundary.

B21t—9 to 14 inches, brown (7.5YR 5/4) light gravelly clay loam that is about 35 percent cobblestones, reddish brown (5YR 4/4) when moist; massive; hard when dry, friable when moist, slightly sticky and plastic when wet; plentiful very fine roots; many very fine, common fine, and a few medium pores that are mainly tubular; thin, discontinuous clay films in pores; medium acid (pH 6.0); gradual, smooth boundary.

B22t—14 to 17 inches, brown (7.5YR 5.5/4) gravelly clay loam that is about 60 percent cobblestones, reddish brown (5YR 4/4) when moist; massive; hard when dry, friable when moist, slightly sticky and plastic when wet; plentiful very fine roots; many very fine and fine pores; thin, discontinuous clay films in pores; medium acid (pH 5.8); abrupt, slightly wavy boundary.

IIB23t—17 to 18 inches, brown (7.5YR 5/3) clay with flecks of light-gray (10YR 7/2) weathered sand that is 35 percent cobblestones, brown (7.5YR 4/2) when moist; massive; very hard when dry, very firm when moist, sticky and very plastic when wet; plentiful very fine roots; common very fine tubular pores; thick clay films nearly fill all voids; strongly acid (pH 5.3); abrupt, slightly wavy boundary; ¼ inch to 2 inches thick, rarely as much as 7 inches thick.

IIC1—18 to 41 inches +, very pale brown (10YR 7/3), light brownish-gray (10YR 6/2), brownish-yellow (10YR 6/6), and gray (5Y 5/1) consolidated, andesitic conglomerate, grayish brown, (10YR 7/3), brown (7.5YR 4/4), dark gray (5Y 4/1), and gray (5Y 5/1) when moist; massive; very hard when dry and extremely firm when moist; almost no roots or pores; medium acid (pH 6.0).

Pentz sandy loam: On a 4 percent slope facing southeast; under annual grasses and forbs; elevation of 500 feet (0.1 mile south of the center of the NW¼ of sec. 30, T. 5 N., R. 10 E.; 0.25 mile southwest of Easterling's house on Strohm's Ranch):

A11—0 to 5 inches, light brownish-gray (10YR 6/2) coarse sandy loam, dark grayish brown (10YR 4/2) when moist; massive when dry, but breaks to weak, very fine, granular structure when moist; slightly hard when dry, friable when moist, nonsticky and nonplastic when wet; abundant very fine roots; many very fine interstitial and tubular pores; medium acid (pH 6.0); clear, smooth boundary.

A12—5 to 10 inches, pale-brown (10YR 6/3) light sandy loam, dark grayish brown (10YR 4/2) when moist, but similar otherwise to the horizon above; clear, smooth boundary.

C1—10 to 16 inches, light-gray (10YR 7/2) loamy sand, brown (10YR 5/3) when moist; massive; slightly hard when dry, friable when moist, nonsticky and nonplastic when wet; plentiful very fine roots; many very fine and fine interstitial and tubular pores; medium acid (pH 6.0); abrupt, wavy boundary.

IIC2—16 to 28 inches, light-gray (10YR 7/2) loamy sand that contains four or five intermittent, thin (¼ to 1 inch thick), indurated, silica-cemented lenses, the lower two lenses being nearly continuous and contain a few thin (¼ to ½ inch thick) bands of pale-brown fine sandy loam that seem to be weakly cemented; the soil is pale brown (10YR 6/3), the lenses are light brownish gray (10YR 6/2), and the bands are grayish brown (10YR 5/2) when moist; massive; the soil is slightly hard when dry, friable when moist, and nonsticky and nonplastic when wet; the lenses are extremely hard when dry; a very few very fine roots form a mat on the uppermost lens; many very fine and fine interstitial and tubular pores; the lower lens has yellowish-brown stains; medium acid (pH 6.0); abrupt, smooth boundary.

IIC3—28 to 45 inches +, similar to above but no roots; lenses are ¼ to ½ inch thick and occur at intervals of 1 to 2 inches; a few thin bands in the upper part; strongly acid (pH 5.5).

The silica-cemented lenses in the IIC2 horizon are assumed to be unrelated to the present weathering cycle.

Perkins loam: On a nearly level terrace; under annual grasses; elevation of 280 feet (100 feet north of Jackson Creek; 0.25 mile south of Buena Vista):

Ap—0 to 8 inches, brown (7.5YR 5/4) loam, dark reddish brown (5YR 3/3) when moist; massive; slightly hard when dry, friable when moist, nonsticky and slightly plastic when wet; abundant very fine roots; many very fine pores; medium acid (pH 6.0); common coarse shot and medium hard shot; abrupt, smooth boundary.

A1—8 to 13 inches, reddish-brown (5YR 5/4) loam, dark reddish brown (5YR 3/3) when moist, with many, medium and fine, faint mottles of reddish brown (5YR 4/4); massive; slightly hard when dry, friable when moist, nonsticky and slightly plastic when wet; abundant very fine roots and plentiful fine roots; many very fine pores and common fine and medium pores; medium acid (pH 5.7); many pebbles; gradual, smooth boundary.

A3—13 to 23 inches, reddish-brown (5YR 5/4) loam, dark reddish brown (5YR 3/4) when moist, with many, medium, faint mottles of reddish brown (5YR 4/4); massive; slightly hard when dry, friable when moist, nonsticky and slightly plastic when moist; plentiful very fine roots; many very fine pores and common fine and medium pores; medium acid (pH 6.0); common fine and medium shot; many pebbles; gradual, smooth boundary.

B1t—23 to 32 inches, red (2.5YR 5/6) clay loam, red (2.5YR 4/6) when moist; massive; hard when dry, slightly firm when moist, slightly sticky and slightly plastic when wet; a few very fine roots; common very fine and fine pores; a few thin clay films in pores; medium acid (pH 6.0); many coarse, very fine, and fine shot; many pebbles; gradual, smooth boundary.

B2t—32 to 40 inches +, red (2.5YR 5/6) gravelly clay loam, red (2.5YR 4/6) when moist; massive; hard when dry, slightly firm when moist, sticky and plastic when wet; a few very fine roots; a few very fine pores; common thin clay films in pores; medium acid (pH 6.0).

Peters clay: On a gentle 4 percent slope facing northeast; under annual grasses and forbs; elevation of 250 feet (0.28 mile east-northeast of the southwest corner of sec. 13, T. 5 N., R. 9 E.; 0.38 mile west of the intersection of Jack Rabbit Road and Camanche road):

A11—0 to 3 inches, dark grayish-brown (10YR 4/2) clay, very dark brown (10YR 2/2) when moist; moderate, fine, granular structure; slightly hard when dry, friable when moist, sticky and plastic when wet; abundant very fine roots; many very fine tubular pores; strongly acid (pH 5.3); abrupt, irregular boundary.

A12—3 to 11 inches, very dark gray (10YR 3/1) clay, very dark gray (2.5Y 3/1) when moist; massive when moist, but strong, coarse, blocky structure when dry; very hard when dry, firm when moist, very sticky and very plastic when wet; abundant very fine roots and a few fine roots; many very fine pores and a few fine pores; a few slickensides; strongly acid (pH 5.5); gradual, smooth boundary.

A13—11 to 21 inches, similar to horizon above, except many very fine roots, common very fine pores; common slickensides, and medium acid (pH 6.0); gradual, smooth boundary.

AC—21 to 32 inches, very dark gray (10YR 3/1) clay variegated with many large splotches of pale yellow (5Y 7/4); black (N 2/0) when moist, variegated with many large splotches of pale olive (5Y 6/4); massive when moist and strong, coarse, blocky structure when dry; hard when dry, firm when moist, very sticky and very plastic when wet; a few very fine roots; a few very fine pores; common slickensides; slightly acid (pH 6.5); clear, irregular boundary.

C1—32 to 36 inches, variegated pale-yellow (5Y 7/4) and very dark grayish-brown (10YR 3/2) clay, variegated pale olive (5Y 6/4) and very dark gray (10YR 3/1) when moist; massive; extremely hard when dry, firm when moist, very sticky and very plastic when wet; almost no roots; a few very fine pores; neutral (pH 7.0); clear, smooth boundary.

C2—36 to 43 inches, pale-yellow (5Y 7/4) clay with dark-gray stains (10YR 4/1), pale olive (5Y 6/4) when moist, with very dark grayish-brown (10YR 3/2) stains; massive; very hard when dry, firm when moist, sticky and plastic when wet; almost no roots or pores; neutral (pH 7.0).

Red Bluff gravelly loam: On an old terrace on an 8 percent slope facing west; under blue oaks and annual grasses; elevation of 250 feet (0.15 mile northeast of the south quarter corner of sec. 9, T. 6 N., R. 9 E.; 0.5 mile northwest of the intersection of State Highway No. 104 and Meiss Road):

A11—0 to 3 inches, reddish-brown (5YR 4/3) gravelly loam that is near gravelly fine sandy loam, dark reddish brown (5YR 3/3) when moist; massive; hard when dry, friable when moist, nonsticky and nonplastic when wet; abundant very fine roots; many very fine, common fine, and a few medium pores; slightly acid (pH 6.5); abrupt, smooth boundary.

A12—3 to 7 inches, reddish-brown (5YR 4/5) gravelly fine sandy loam that is near gravelly loam, dark reddish brown (5YR 3/4) when moist; massive; hard when dry, friable when moist, slightly sticky and slightly plastic when wet; abundant very fine and fine pores and a few medium and coarse pores; occasional thin, discontinuous clay films; slightly acid (pH 6.1); clear, smooth boundary.

B21—7 to 11 inches, yellowish-red (5YR 4/6) loam that is near clay loam, dark reddish brown (2.5YR 3/5) when moist; massive; hard when dry, friable when moist, slightly sticky and slightly plastic when wet; plentiful very fine and fine roots and a few medium and coarse roots; many very fine, common fine, and a few medium and coarse pores; thin, continuous clay films in pores; very strongly acid (pH 5.3); clear, smooth boundary.

B21t—11 to 19 inches, red (2.5YR 4/6) clay, dark red (10YR 3/6) when moist; massive; hard when dry, firm when moist, sticky and plastic when wet; a few very fine, fine, and medium roots; common very fine pores and a few fine, medium, and coarse pores; moderately thick, continuous clay films in pores and as bridges; extremely acid (pH 4.0); gradual, smooth boundary.

B22t—19 to 27 inches, weak-red (10R 4/4) clay with common streaks of pale brown (10YR 6/3), dark red (10R 3/6), and brown (10YR 5/3) when moist; massive; very hard when dry, very firm when moist, sticky and plastic when wet; a few fine and medium roots; common very fine, medium, and coarse pores; thick, continuous clay films in pores and as bridges; extremely acid (pH 3.6); gradual, smooth boundary.

IIB3t—27 to 40 inches, pale-brown (10YR 6/3) gravelly clay with dark-red (10R 3/6) coatings, brown (10YR 5/3) with dark-red (10R 3/6) coatings when moist; massive; very hard when dry, extremely firm when moist, sticky and plastic when wet; occasional roots; a few very fine and fine pores; common thick clay films in pores and along fracture planes; extremely acid (pH 3.8).

Depth to the Ione formation is assumed to be 27 inches. It is likely, however, that in dissection of the Arroyo Seco pediment mixing occurred in places at a depth between 11 and 27 inches and that the clay texture in the B21t and B22t horizons is caused in part by this mixing.

Ryer silty clay loam: On a nearly level low terrace; under annual grasses and forbs; elevation of 240 feet (0.08 mile north of the south quarter corner of sec. 32, T. 7 N., R. 9 E.; 0.19 mile northwest of Carbondale):

A1—0 to 6 inches, variegated light yellowish-brown (10YR 6/4) and strong-brown (7.5YR 5/6) light silty clay loam, brown (10YR 4/3) and yellowish red (5YR 4/6) when moist; massive; hard when dry, friable when moist, slightly sticky and slightly plastic when wet; abundant very fine roots; many very fine pores and a few fine tubular pores; medium acid (pH 6.0); abrupt, smooth boundary.

A3—6 to 13 inches, variegated light yellowish-brown (10YR 6/4) and strong-brown (7.5YR 5/6) light silty clay loam, brown (7.5YR 5/4) when moist; massive; very hard when dry, friable when moist, slightly sticky and slightly plastic when wet; plentiful very fine roots; many very fine tubular and interstitial pores; a few thin clay films line tubular and interstitial pores; medium acid (pH 6.0); gradual, smooth boundary.

B1t—13 to 18 inches, light yellowish-brown (10YR 6/4) silty clay loam, brown to dark brown (7.5YR 4/4) when moist; massive, but breaks to strong, coarse, angular blocky structure; very hard when dry, firm when moist, sticky and plastic when wet; plentiful very fine roots; many very fine tubular and interstitial pores; common thin clay films line tubular and interstitial pores; medium acid (pH 5.8); gradual, smooth boundary.

B21t—18 to 26 inches, brown (7.5YR 5/3) heavy silty clay loam, dark brown (7.5YR 4/3) when moist; moderate, medium, prismatic structure to strong, coarse, angular blocky; extremely hard when dry, firm when moist, slightly sticky and plastic when wet; plentiful very fine roots; many very fine tubular and interstitial pores; continuous, moderately thick clay films on ped faces; many moderately thick clay films line pores; neutral (pH 6.8); gradual, smooth boundary.

B22t—26 to 39 inches, dark-brown (7.5YR 5/4) heavy silty clay loam with coatings of reddish brown (5YR 4/3), reddish brown (5YR 4/3) with coatings of dark brown (7.5YR 4/3) when moist; weak, medium, prismatic structure; extremely hard when dry, firm when moist, plastic and slightly sticky when wet; plentiful very fine roots, along the interfaces of adjacent peds; many very fine tubular and interstitial pores; clay films same as in horizon above; mildly alkaline (pH 7.5); distinct, smooth boundary.

B31t—39 to 56 inches, light yellowish-brown (10YR 6/4) silty clay loam with coatings of brown (7.5YR 4/4); dark brown (7.5YR 4/3) with coatings of reddish brown (5YR 4/3) when moist; weak, medium, prismatic structure; very hard when dry, firm when moist, plastic and slightly sticky when wet; a few very fine roots along the interfaces of adjacent peds; many very fine tubular and interstitial pores; continuous, moderately thick clay films on ped faces; many moderately thick clay films in pores; mildly alkaline (pH 7.5); gradual, smooth boundary.

B32t—56 inches +, light yellowish-brown (10YR 6/4) silty clay loam with coatings of brown (7.5YR 4/4); dark brown (7.5YR 4/3), brown (7.5YR 5/2), and strong brown (7.5YR 5/6) with coatings of reddish brown (5YR 4/3) when moist; massive; very hard when dry, firm when moist, plastic and slightly sticky when wet; a few very fine roots; pores same as in horizon above but more numerous; common, moderately thick clay films in pores and adjacent areas; neutral (pH 7.0).

Shaver coarse sandy loam: On a 12 percent slope facing southeast; under ponderosa pine, manzanita, and live oak; elevation of 2,400 feet (0.35 mile northwest of the center

of sec. 6, T. 6 N., R. 13 W.; 2 miles south-southwest of Pioneer station):

O1—1 to 0 inch of partly decomposed forest litter.
A1—0 to 18 inches, brown (10YR 5/3) coarse sandy loam, very dark grayish brown (10YR 3/2) when moist; massive; soft when dry, friable when moist; plentiful very fine roots and a few fine to coarse roots; many very fine pores and a few fine pores; medium acid (pH 6.0); diffuse, lower boundary.
B2—18 to 48 inches, brown (10YR 5/3) coarse sandy loam, dark brown (10YR 3/3) when moist; massive; slightly hard when dry, friable when moist; a few very fine to coarse roots; many very fine pores and a few fine pores; medium acid (pH 6.0); diffuse, lower boundary.
C—48 to 65 inches +, yellowish-brown (10YR 5/4) coarse sandy loam, brown (10YR 4/3) when moist; massive; hard when dry, friable when moist; a few very fine to coarse roots; many very fine pores and a few fine pores; medium acid (pH 6.0); diffuse, lower boundary.

Shenandoah loam: In the lower part of a broad swale on a 3 percent slope facing north; under annual grasses and forbs (formerly cultivated); elevation of 1,250 feet (0.1 mile east of the south quarter corner of sec. 36, T. 8 N., R. 11 E.; 1.5 miles northeast of Plymouth):

Ap—0 to 6 inches, light brownish-gray (10YR 6/2) loam, dark grayish brown (10YR 4/2) with many, medium, prominent, mottles of reddish brown (5YR 4/4) when moist; massive; slightly hard when dry, friable when moist, nonsticky and nonplastic when wet; abundant very fine roots; many very fine tubular and interstitial pores; medium acid (pH 6.0); a few shot 2 to 5 millimeters in diameter; abrupt, smooth boundary.
A11—6 to 17 inches, pale-brown (10YR 6/3) loam, variegated dark grayish brown (10YR 4/2), dark brown (10YR 4/3), and brown (7.5YR 4/4) when moist; massive; slightly hard when dry, friable when moist, slightly sticky and slightly plastic when wet; plentiful very fine roots; many very fine interstitial and tubular pores; medium acid (pH 5.8); common shot 2 to 5 millimeters in diameter; gradual, smooth boundary.
A12—17 to 24 inches, pale-brown (10YR 6/3) loam with many large distinct brown (7.5YR 4/3) mottles, variegated brown (10YR 5/3) and dark brown (7.5YR 4/3) when moist; massive; slightly hard when dry, friable when moist, slightly sticky and slightly plastic when wet; plentiful very fine roots; many very fine tubular and interstitial pores; very strongly acid (pH 5.0); common shot 2 to 5 millimeters in diameter; very abrupt, smooth boundary.
B2t—24 to 32 inches, light brownish-gray (2.5Y 6/2) clay with many, medium, distinct, mottles of light olive brown (2.5Y 5/4); grayish brown (2.5Y 5/2) with many, medium, distinct mottles of yellowish brown (10YR 5/4) when moist; moderate, medium, angular blocky structure; extremely hard when dry, very firm when moist, sticky and plastic when wet; a few very fine roots; many very fine tubular and interstitial pores; many moderately thick clay films on ped faces; continuous, moderately thick clay films in pores; medium acid (pH 5.8); clear, smooth boundary.
B3t—32 to 40 inches, light yellowish-brown (2.5Y 6/4) and light olive-brown (2.5Y 5/4) sandy loam with white specks (2.5Y 8/2), very dark gray (10YR 3/1) and white (10YR 8/1) with yellowish brown (10YR 5/6) in pores when moist; massive; very hard when dry, very firm when moist, slightly sticky and nonplastic when wet; a few very fine roots; a few very fine interstitial pores; common moderately thick, clay films in pores; medium acid (pH 6.0); granitic structure fairly evident; gradual, smooth boundary.
R—40 to 46 inches+, slightly weathered, platy granite.

Sierra coarse sandy loam: On a convex 9 percent slope facing south; under annual grasses (formerly cultivated); elevation of 1,610 feet (0.35 mile east-southeast of the center of sec. 19, T. 8 N., R. 11 E.; 0.03 mile northeast of the intersection of the Plymouth Shenandoah Road and the Shenandoah School Road):

Ap—0 to 6 inches, brown (7.5YR 5/4) coarse sandy loam, dark reddish brown (5YR 3/3) when moist; massive; slightly hard when dry, friable when moist, nonsticky and nonplastic when wet; abundant very fine roots; many very fine and common medium-fine tubular pores; medium acid (pH 6.0); abrupt, smooth boundary.
A3—6 to 15 inches, yellowish-red (5YR 5/6) loam, dark red (2.5YR 3/6) when moist; massive; hard when dry, friable when moist, slightly sticky and slightly plastic when wet; plentiful very fine roots; many very fine and medium-fine tubular pores; a few thin, discontinuous clay films in pores and as bridges; medium acid (pH 5.9); clear, smooth boundary.
B1t—15 to 24 inches, yellowish-red (5YR 5/6) clay loam, dark red (2.5YR 3/6) when moist; massive; very hard when dry, friable when moist, slightly sticky and slightly plastic when wet; a few very fine roots; many very fine and medium-fine tubular pores; a few thin, continuous clay films in pores and adjacent areas; medium acid (pH 6.0); clear, smooth boundary.
B21t—24 to 33 inches, red (2.5YR 5/6) clay loam, dark red (2.5YR 3/6) when moist; massive; very hard when dry, firm when moist, sticky and slightly plastic when wet; a few fine roots; many very fine and medium-fine tubular pores; common thin, continuous clay films in pores and adjacent areas; slightly acid (pH 6.2); gradual, smooth boundary.
B22t—33 to 45 inches, red (2.5YR 5/6) clay loam, red (2.5YR 4/6) when moist; massive; very hard when dry, firm when moist, sticky and plastic when wet; a few fine roots; a few very fine tubular pores; slightly acid (pH 6.3); clear, smooth boundary.
B3t—45 to 66 inches, yellowish-red (5YR 5/6) clay loam, red (2.5YR 4/6) when moist; massive; very hard when dry, firm when moist, sticky and plastic when wet; a few very fine tubular pores; a few fine roots; common thin, continuous clay films in pores and adjacent areas; slightly acid (pH 6.5); abrupt, wavy boundary.
C1—66 to 73 inches, reddish-yellow (7.5YR 7/6) sandy loam, yellowish red (5YR 5/6) when moist; massive; hard when dry, friable when moist, slightly sticky and nonplastic when wet; a few very fine pores; thin, discontinuous clay films in pores and coating sand grains; medium acid (pH 6.0).

Sites gravelly loam: On an 18 percent slope facing northwest; under conifers and bracken ferns (formerly in walnuts); elevation of 2,800 feet (northeast corner of sec. 9, T. 6 N., R. 12 E.; 0.4 mile north of Mount Zion Lookout Station):

O1—½ to 0 inch of pine needles.
Ap—0 to 8 inches, brown (7.5YR 5/4) gravelly loam, dark reddish brown (5YR 3/4) when moist; strong very fine and fine granular structure; slightly hard when dry, friable when moist, nonsticky and slightly plastic when wet; plentiful very fine, fine, and medium roots; a few coarse tubular and interstitial pores and many very fine and fine tubular and interstitial pores; slightly acid (pH 6.3); abrupt, smooth boundary.
A1—8 to 15 inches, reddish-brown (5YR 4/5) gravelly heavy loam, dark reddish brown (5YR 3/4) when moist; moderate, very fine and fine, granular structure (massive in place); consistence, roots, pores, and pH as in the horizon above, except that a few medium pores are present; gradual, smooth boundary.
B11t—15 to 27 inches, reddish-brown (5YR 4/5) gravelly clay loam, dark red (2.5YR 3/6) when moist; structure, consistence, roots, and pores as in the horizon above, except that the soil is slightly sticky when wet; a few, thin, discontinuous clay films in pores; slightly acid (pH 6.4); gradual, smooth boundary.
B12t—27 to 35 inches, similar to the B11t horizon, except that pH is 6.3; gradual, smooth boundary.

B21t—35 to 45 inches, yellowish-red (5YR 4/6) gravelly clay, dark red (2.5YR 3/7) when moist; weak, very fine, subangular blocky structure when crushed; slightly hard when dry, firm when moist, slightly sticky and slightly plastic when wet; a few very fine and fine roots and a few medium roots; many fine and very fine tubular and interstitial pores and a few medium tubular and interstitial pores; moderately thick, continuous clay films in pores and as bridges; slightly acid (pH 6.2); gradual, smooth boundary.

B22t—45 to 55 inches, yellowish-red (5YR 4/7) gravelly clay, dark red (2.5YR 3/7) when moist; massive; slightly hard when dry, very firm when moist, slightly sticky and plastic when wet; roots as in horizon above; common very fine tubular pores and a few fine tubular pores; moderately thick, continuous clay films in pores and as bridges; interstitial pores nearly filled with colloid; slightly acid (pH 6.2); gradual, smooth boundary.

B3t—55 to 67 inches, yellowish-red (5YR 5/6) gravelly clay, yellowish-red (5YR 4/6) with dark-red (2.5YR 3/7) colloidal coatings when moist; slightly hard when dry, firm when moist, slightly sticky and plastic when wet; roots and pores as in the horizon above; thin, continuous clay films in pores; medium acid (pH 6.0); gradual, smooth boundary.

C1—67 to 72 inches, brownish-yellow (10YR 6/5) gravelly loam, yellowish brown (10YR 5/6) with yellowish-red clay films (5YR 4/6) when moist; massive; slightly hard when dry, friable when moist, nonsticky and nonplastic when wet; a few very fine and fine roots; a few very fine and fine tubular pores; occasional thin, continuous clay films on pebbles and in pores; medium acid (pH 5.6); gradual, smooth boundary.

R—72 inches +, very dark bluish-gray (5B 3/1), fine-grained, somewhat weathered, hard schist, with yellowish-red (5YR 5/6) to light olive-brown (2.5Y 5/4) coatings along fracture planes.

Snelling sandy loam: On an isolated terrace on a 3 percent slope facing northwest; under annual grasses and a few oaks; (0.2 mile west of the center of sec. 3, T. 5 N., R. 9 E.; 0.75 mile north-northeast of the intersection of State Highway No. 88 and Five Mile Drive Road):

A1—0 to 16 inches, brown to dark-brown (7.5YR 4/2) sandy loam, dark brown (7.5YR 3/2) when moist; upper 0 to 1 inch single grain, below essentially massive, but breaks to very weak, coarse, granular structure; soft when dry, very friable when moist; abundant very fine and fine roots; many fine and very fine interstitial pores; slightly acid (pH 6.5); clear, wavy boundary.

B1t—16 to 24 inches, reddish-brown (5YR 6/4), heavy sandy loam, mostly reddish brown (5YR 4/4) with some streaks of dark brown (7.5 YR 3/2) when moist; massive to very weak, coarse, subangular blocky structure; soft when dry, friable when moist, slightly plastic and slightly sticky when wet; thin patchy clay films as bridges and on sand grains; slightly acid (pH 6.3); clear, wavy boundary.

B2t—24 to 36 inches, yellowish-red (5YR 6/6) sandy clay loam, yellowish red (5YR 4/6), with brown (7.5YR 5/3) coatings on vertical surfaces of prisms, when moist; massive to weak, very coarse, subangular blocky structure; slightly hard when dry, friable when moist, plastic and sticky when wet; moderate, continuous clay films, mainly as bridges and as coatings on sand grains; slightly acid (pH 6.3); gradual, wavy boundary.

B3t—36 inches +, reddish-yellow (7.5YR 6/4) sandy clay loam, yellowish red (5YR 4/6) when moist; many fine grains of white quartz; massive; slightly hard when dry, friable when moist, plastic and sticky when wet; patchy clay films coating sand grains and as bridges; slightly acid (pH 6.3).

Snelling loam, moderately well drained: On a 3 percent slope facing south-southeast; under annual grasses (formerly cultivated); elevation of 1,585 feet (0.25 mile northwest of the southeast corner of sec. 19, T. 8 N., R. 11 E.; 0.2 mile south of the intersection of the Plymouth Shenandoah Road and the Shenandoah School Road):

Ap—0 to 6 inches, brown (10YR 5/3) gritty loam, dark brown (10YR 3/3) when moist; massive; hard when dry, friable when moist, slightly sticky and slightly plastic when wet; abundant very fine roots; many very fine tubular and interstitial pores; strongly acid (pH 5.3); abrupt, smooth boundary.

A1—6 to 11 inches, similar to the horizon above, except abundant very fine tubular and interstitial pores and a few fine tubular and interstitial pores; strongly acid (pH 5.5); gradual, smooth boundary.

B1t—11 to 24 inches, brown (10YR 5/3) gritty clay loam, dark brown (7.5YR 3/2) when moist; massive; hard when dry, friable when moist, slightly sticky and slightly plastic when wet; abundant very fine roots; many very fine tubular and interstitial pores and a few fine tubular and interstitial pores; common thin clay films in pores; medium acid (pH 6.0); diffuse, smooth boundary.

B2t—24 to 37 inches, pale-brown (10YR 6/3) sandy clay loam, dark brown (7.5YR 4/4) when moist, with common, medium, distinct mottles of grayish brown (10YR 5/2); massive; very hard when dry, friable when moist, sticky and plastic when wet; plentiful very fine roots; many very fine tubular and interstitial pores and a few fine tubular and interstitial pores; many thin clay films in pores; medium acid (pH 6.0); diffuse, smooth boundary.

B3t—37 to 50 inches, pale-brown (10YR 6/3) heavy coarse sandy loam, dark brown (7.5YR 3/3) when moist, with common, medium, distinct mottles of dark brown (7.5YR 4/4); massive; hard when dry, friable when moist, slightly sticky and plastic when wet; a few very fine roots; many very fine tubular pores and a few fine tubular and interstitial pores; common thin clay films in pores; medium acid (pH 6.0); diffuse, smooth boundary.

C1—50 to 60 inches +, pale-brown (10YR 6/3) coarse sandy loam, dark brown (7.5YR 3/3) when moist, with common, medium, distinct mottles of dark brown (7.5YR 3/4); massive; slightly hard when dry, friable when moist, slightly sticky and slightly plastic when wet; a few very fine roots; many very fine tubular and interstitial pores and a few fine tubular and interstitial pores; medium acid (pH 6.0).

Supan cobbly loam: On a broad ridge on a 3 percent slope facing southwest; under grass-oak; elevation of 1,200 feet (0.19 mile south of the north quarter corner of sec. 26, T. 6 N., R. 10 E.; 3 miles southwest of Martell and 100 feet north of State Highway No. 88):

Ap—0 to 8 inches, reddish-brown (5YR 4/3) cobbly loam, dark reddish brown (5YR 3/2) when moist; moderate, fine, granular structure in the upper 2 inches, massive below; soft when dry, friable when moist, nonsticky and nonplastic when wet; abundant very fine roots in the upper 2 inches, plentiful below; many very fine pores; slightly acid (pH 6.3); clear, smooth boundary.

B11t—8 to 16 inches, reddish-brown (5YR 4/3) cobbly clay loam, dark reddish brown (5YR 3/2) when moist; massive between krotovinas, but strong, fine, granular structure within them; soft when dry, friable when moist, nonsticky and slightly plastic when wet; plentiful fine and very fine roots; many very fine and fine pores and a few medium pores; thin, discontinuous clay films in most pores; slightly acid (pH 6.5); gradual, wavy boundary.

B12t—16 to 22 inches, reddish-brown (5YR 4/3) cobbly gravelly clay loam, dark reddish brown (5YR 3/4) when moist; massive; slightly hard when dry, friable when moist, nonsticky and slightly plastic when wet; plentiful very fine and fine roots; many very fine and fine pores and a few medium pores; clay films thin and nearly continuous in pores; neutral (pH 6.8); clear, wavy boundary.

B2t—22 to 38 inches, reddish-brown (5YR 4/4) cobbly clay loam, dark reddish brown (2.5YR 3/4) when moist;

massive; hard when dry, firm when moist, slightly sticky and plastic when wet; plentiful very fine and fine roots; common very fine and fine pores and a few medium pores; moderately thick, continuous clay films in pores and as bridges; neutral (pH 7.3); gradual, wavy boundary.

B31t—38 to 58 inches, reddish-brown (5YR 4/4) cobbly sandy clay loam, dark reddish brown (2.5YR 3/4) when moist; massive; slightly hard when dry, friable when moist, slightly sticky and plastic when wet; a few very fine and fine roots; common very fine and fine pores; thin, discontinuous clay films in pores, mainly as bridges; about 40 to 50 percent of the mass is cobblestones more than an inch in diameter; mildly alkaline (pH 7.5); gradual, wavy boundary.

B32t—58 to 70 inches, reddish-brown (5YR 5/4) cobbly gravelly loam with yellowish-red (5YR 4/6) coatings, reddish brown (2.5YR 4/4) when moist with dark reddish-brown (2.5YR 3/4) coatings; massive; very hard when dry, firm when moist, nonsticky and slightly plastic when wet; neutral (pH 7.2); otherwise similar to the horizon above; gradual, wavy boundary.

R—70 to 75 inches, weathered massive conglomerate, the andesitic cobblestones less weathered and darker with increasing depth; neutral (pH 6.9).

Supan very cobbly loam, moderately deep: On a convex 35 percent slope facing north; under oaks, pines, shrubs, and forbs; elevation of 1,920 feet (0.15 mile west of the east quarter corner of sec. 3, T. 6 N., R. 11 E.; 3.25 miles east-northeast of Sutter Hill on Ridge Road):

A1—0 to 4 inches, dark-brown (7.5YR 4/2) very cobbly loam, dark reddish brown (5YR 2/2) when moist; moderate, medium, granular structure; slightly hard when dry, friable when moist, nonsticky and nonplastic when wet; abundant very fine and fine roots and a few coarse roots; many very fine and fine interstitial pores; slightly acid (pH 6.5); clear, smooth boundary.

A3—4 to 14 inches, dark-brown to brown (7.5YR 4/4) very cobbly loam, dark reddish brown (5YR 3/2) when moist; massive to weak, medium subangular blocky structure; slightly hard when dry, friable when moist, nonsticky and nonplastic when wet; plentiful very fine, fine, and coarse roots; many very fine and fine interstitial and tubular pores; medium acid (pH 6.3); clear, wavy boundary.

B2t—14 to 24 inches, brown (7.5YR 5/4) very cobbly clay loam, dark reddish brown (5YR 3/4) when moist; massive to weak, medium, subangular blocky structure; hard when dry, friable when moist, slightly sticky and slightly plastic when wet; a few very fine and fine roots and plentiful coarse roots; many very fine and fine pores and a few coarse pores; common moderately thick clay films in interstitial and tubular pores; medium acid (pH 6.0); gradual, irregular boundary.

B3—24 to 30 inches, brown (7.5YR 5/4) very cobbly sandy clay loam, yellowish red (5YR 3/6) when moist; massive to weak, subangular blocky structure; hard when dry, friable when moist, slightly plastic and slightly sticky when wet; a few very fine, fine, and coarse roots; common very fine and fine interstitial and tubular pores and a few coarse interstitial and tubular pores; common moderately thick clay films in pores; medium acid (pH 5.9); abrupt, irregular boundary.

C1—30 inches +, reddish-yellow (7.5YR 6/6) partly weathered tuffaceous material cementing dominantly andesitic cobblestones, but also other stones; mostly pinkish white (7.5YR 3/2) when moist, with flecks of red (2.5YR 5/6) and black (N/1); extremely hard; very firm; common moderately thick clay films in cleavages; medium acid (pH 5.9).

Tiger Creek very rocky loam: On an 88 percent slope facing northwest; under conifers, oaks, and bracken ferns; elevation of 2,240 feet (0.25 mile north of the center of sec. 35, T. 7 N., R. 12 E.; 1.5 miles south-southeast of Volcano on Sutter Creek):

O1—2 to 0 inches of needles, duff, and decomposing litter.

A1—0 to 6 inches, dark reddish-brown (5YR 3/3) very rocky loam, dark reddish brown (5YR 2/3) when moist; strong, very fine, granular structure; soft when dry, very friable when moist, slightly sticky and slightly plastic when wet; abundant very fine roots and a few fine roots; many very fine pores and a few fine pores; mildly alkaline (pH 7.5); abrupt, smooth boundary.

B1—6 to 15 inches, reddish-brown (2.5YR 4/4) very rocky loam, reddish brown (5YR 3/4) when moist; massive to very fine, subangular blocky structure; slightly hard when dry, friable when moist, slightly sticky and slightly plastic when wet; plentiful very fine roots and a few fine roots; many very fine pores and a few fine pores; a few thin, discontinuous clay films in pores; mildly alkaline (pH 7.5); clear, smooth boundary.

B2t—15 to 26 inches, dark reddish-brown (2.5YR 3/4) very rocky clay loam, dark red (2.5YR 2/6) when moist; massive; extremely hard when dry, firm when moist, sticky and plastic when wet; a few very fine to coarse roots; many very fine pores and a few fine and medium pores; many thick, continuous clay films in pores and on sand grains; mildly alkaline (pH 7.5); gradual, smooth boundary.

B31t—26 to 36 inches, dark reddish-brown (2.5YR 3/4) extremely rocky loam, dark red (2.5YR 2/6) when moist; massive; hard when dry, friable when moist, slightly sticky and slightly plastic when wet; a few very fine to coarse roots; many very fine pores; common thin, continuous clay films in pores; mildly alkaline (pH 7.5); diffuse, lower boundary.

B32t—36 to 54 inches +, dark reddish-brown (2.5YR 3/4) extremely rocky loam, dark red (2.5YR 3/6) when moist; massive; hard when dry, friable when moist; slightly sticky and slightly plastic when wet; a few very fine to medium roots; many very fine pores; thin, continuous clay films in pores but less numerous than in the horizon above; mildly alkaline (pH 7.5); boundary undetermined.

Windy cobbly sandy loam: On a 25 percent slope facing south; under ponderosa pines, incense-cedars, red and white firs, and a few shrubs; elevation of 5,445 feet (0.25 mile east of the SW corner of sec. 13, T. 8 N., R. 14 E., 0.15 mile southwest of Armstrong Lookout Station):

O1—2 to 0 inches of partly decomposed and well-decomposed tree needles; very strongly acid (pH 5.0).

A11—0 to 8 inches, dark grayish-brown (10YR 4/2) sandy loam, very dark brown (10YR 2/2) when moist; moderate, very fine, granular structure; slightly hard when dry and friable when moist; plentiful very fine to medium roots; many very fine interstitial pores; 10 percent of the horizon consists of gravel and cobblestones, by volume; medium acid (pH 6.0); gradual, smooth boundary.

A12—8 to 16 inches, dark grayish-brown (10YR 4/2) sandy loam, very dark brown (10YR 2/3) when moist; moderate, very fine, granular structure; soft when dry and friable when moist; plentiful very fine to very coarse roots; many very fine interstitial pores; 15 percent of the horizon consists of gravel and cobblestones; medium acid (pH 6.0); gradual, smooth boundary.

AB—16 to 21 inches, dark grayish-brown (10YR 4/2) sandy loam, dark brown (10YR 3/3) when moist; moderate, very fine, granular structure; soft when dry and friable when moist; plentiful very fine to very coarse roots; many very fine interstitial pores; 40 percent of the horizon consists of gravel and cobblestones; medium acid (pH 6.0); clear, smooth boundary.

B2—21 to 35 inches, brown (10YR 5/3) sandy loam, dark yellowish brown (10YR 3/4) when moist; moderate, very fine, granular structure; soft when dry and friable when moist; plentiful very fine to medium roots and a few coarse and very coarse roots; many very fine interstitial pores; 50 percent of the horizon consists of gravel and cobblestones; medium acid (pH 5.8); abrupt, slightly irregular boundary.

C1—35 to 47 inches, brown (10YR 5/3) sandy loam, dark yellowish brown (10YR 3/4) when moist; moderate, very fine, granular structure; soft when dry and friable when moist; plentiful very fine to fine roots and a few medium and coarse roots; many very fine interstitial pores; 90 percent of the horizon consists of decomposing cobblestones and other stones; medium acid (pH 5.8); gradual, slightly irregular boundary.

C2—47 to 57 inches, fractured, rotten andesitic tuff breccia, variegated with dark yellowish brown (10YR 4/4), yellowish brown (10YR 5/6), and olive brown (5Y 5/2) when dry; unweathered portions have a purplish cast; a few very fine to medium roots; strongly acid (pH 5.5); clear, slightly irregular boundary.

C3—57 inches +, rotten, fairly massive andesitic tuff breccia that can be scratched with a knife when wet; no roots; very strongly acid (pH 5.0).

General Nature of the Area

The physiography, relief, and drainage of the Area are discussed in this section, and facts are given about the climate, the water supplies, and the ownership of the land. Also discussed are development and population, community facilities, and industries and transportation.

Physiography, Relief, and Drainage

Amador Area is almost entirely in the Sierra Nevada section of the Sierra Cascade Mountains. Only the extreme western part is in the Great Valley of California. The part of the Area in the Sierra range is dominated by steeply dipping, faulted and folded metamorphic rocks that have been intruded by several types of igneous rocks. Overlying the bedrock in many places are mantles of river gravel and volcanic debris. In the southwest corner adjoining the Great Valley are sediments from an ancient inland sea.

The ascent from the Great Valley is gentle, and the average slope through a west to east transect is about 3 percent. In general, the trend of ridges and rock formations is northwest to southeast. Drainage is generally

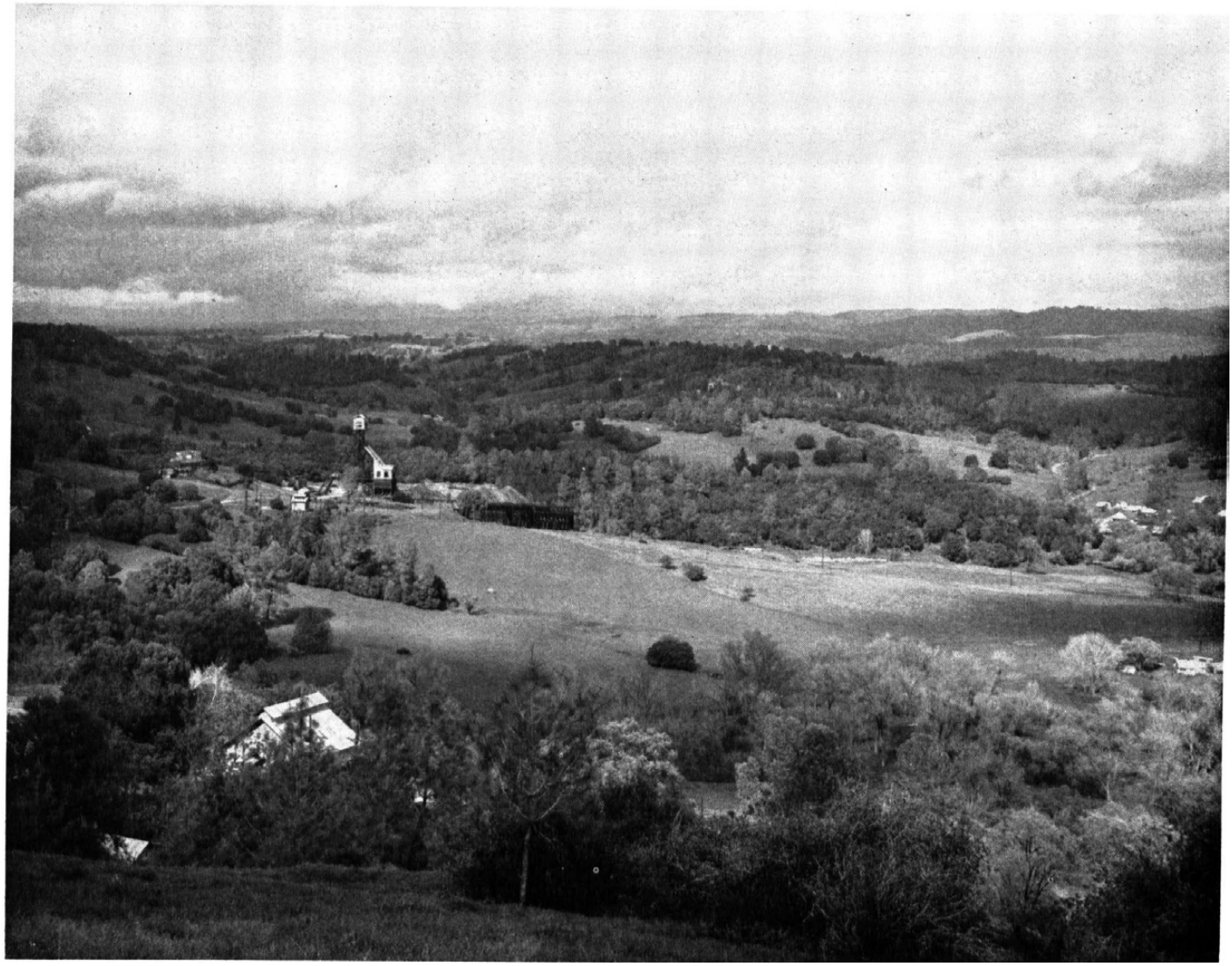


Figure 26.—**Typical view, looking east from Argonaut Mine Hill, of Supan soils on flat-topped ridges just behind the shaft of the Kennedy Mine.**

toward the southwest, and drainage channels cut through geologic formations and follow the westward tilting of the Sierran fault block. The headward parts of the major streams and rivers are more deeply gouged by river canyons and drainageways than the more rolling foothills where river cutting is less. Typically, the folded and faulted areas of metasedimentary rocks are steep and angular, the granitic areas are rounded and smooth, and areas capped with volcanic conglomerate are flat topped and smooth (fig. 26).

The Area is drained mainly by the Mokelumne River on the south and the south fork of the Cosumnes River along the northern border. These rivers join the Sacramento River in Sacramento County and flow into San Francisco Bay and the Pacific Ocean. Jackson, Sutter, Dry Creeks, and other major streams combine at the western boundary of the county, continue on to form part of the southern boundary of Sacramento County, and then join the Cosumnes River. These creeks are perennial, but after a succession of years when rainfall is below average, they are dry most of the summer months. Numerous minor drainageways join the streams, and most of them originate in Amador County.

Climate [6]

The Amador Area generally has warm, dry summers and mild winters. Occasionally, however, thundershowers occur in summer at the higher elevations. Also, temperatures of more than 100° F. occur nearly every year, and sometimes temperatures drop well below freezing in winter. Most of the precipitation comes during the 6 months of winter, and the seasonal total ranges from less than 20 inches at low elevations to more than 40 inches at higher elevations. In the lower foothills there is little snowfall, but at higher elevations the amount of snowfall is fairly large.

In general, temperatures decrease with increase in altitude, but in low, sheltered areas cold air tends to accumulate. As a result, in these low places the average temperature is somewhat cooler than on the adjoining slopes. The amount of precipitation generally increases with increase in elevation. Most of the precipitation in winter falls when a southwest wind is blowing, and much of it falls on the windward side of the hills. When precipitation is heavy, however, the upper parts of the leeward side of the slope sometimes receive large amounts of moisture carried over from the windward side. Because the main drainageways run in a southwesterly direction, west and southwest winds can sweep up the slopes of the Area with little resistance. Locally, however, many places are sheltered from winds by configurations of the terrain.

Estimates of weather conditions in the Area are based on data from weather offices of the U.S. Weather Bureau in the Amador Area, in other parts of Amador County, and in surrounding counties. Locations of the weather stations are shown in figure 27.

Temperature and growing season

The average annual temperature in the Amador Area ranges from nearly 65° F. at the lower elevations to about 56° at the upper end of the Area, toward the east. Minimum temperatures are most affected by local variations in the terrain. The January average minimum temperature decreases from nearly 38° at the lowest elevation to about 31° at the Tiger Creek Powerhouse, elevation 2,350 feet. At the Salt Springs Powerhouse, however, at an elevation of 3,700 feet, the average minimum temperature is 32.4°. These data suggest the effect of local exposure on the temperature. The lowest readings recorded in the Area range from 6° at Tiger Creek Powerhouse to 17° and 18° at lower elevations.

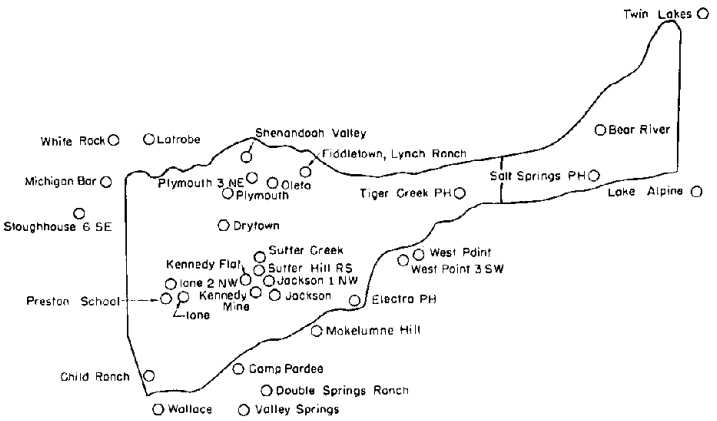


***Figure 27.*—Weather stations in the Amador Area and in surrounding areas; the letters PH and RS, following some of the station names, mean "powerhouse" and "ranger station," respectively; the figure and letters following the names of some other stations stand for distance and direction.**

Average maximum readings in July are in the 90's, and they range from about 92° at higher elevations to nearly 98° in lower places. The highest temperatures recorded are 110° in the higher, eastern part of the Area and 115° in the lower, western part. These and other temperature data are given in figure 28.

The growing season, which is the interval between the last temperature of 32° F. or lower in spring and the first in fall, ranges from 200 to 300 days. The average date of the last 32° temperature in spring is about the first of March in the low areas and about the last of April in the higher areas; and in fall, the average date of the first freezing temperature ranges from the first of November in the cool parts of the Area to the middle or latter part of December in the warmer parts (see fig. 28). Table 11 shows the probability of temperatures of 32°, or colder, and 28°, or colder, in spring and fall.

Precipitation

In the Amador Area, precipitation in the driest part, the southwest corner, is about 19 inches per year. But, at the upper end of the Area, toward the east, precipitation averages about 45 inches a year (fig. 29).

The total annual precipitation varies considerably from year to year. In 9 years out of 10, 12.4 inches of precipitation can be expected in the southwest corner of the Area and about 26.5 can be expected in the upper end of the Area, toward the east. On the other hand, in 1 year out of 10 more than 26 inches of moisture can be expected in the lower parts of the Area and more than 64 inches can be expected in the higher parts. Table 12 shows the probability of receiving total annual precipitation greater than indicated for reporting points in and near the Area.

[6] By C. R. Elford, State climatologist, California, U.S. Weather Bureau.

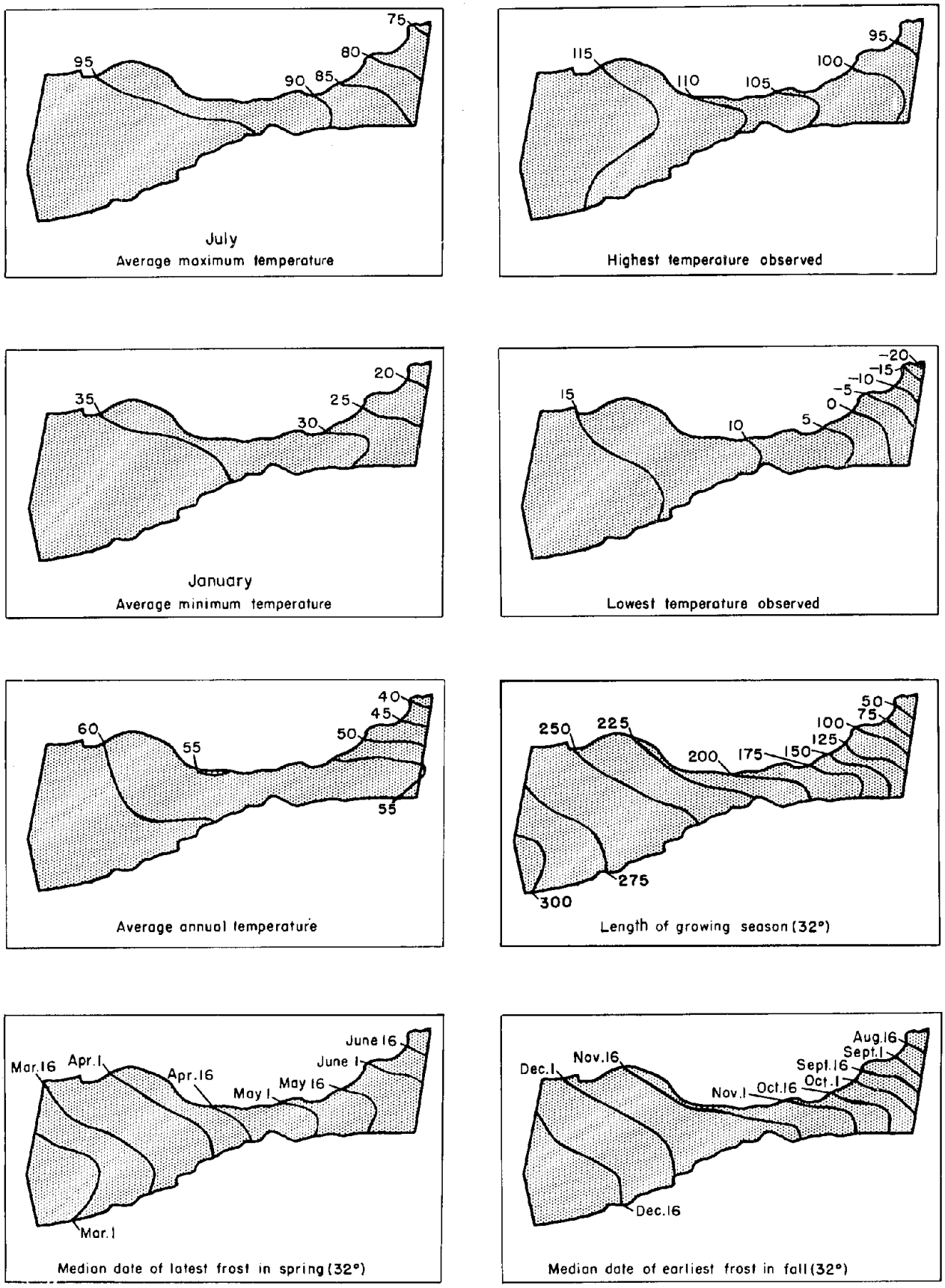


Figure 28.—Temperature, frost data (32°), and length of growing season in Amador Area and adjoining areas.

TABLE 11.—*Probability of temperatures of 32° or colder, and 28° or colder, after specified dates in spring and before specified dates in fall*

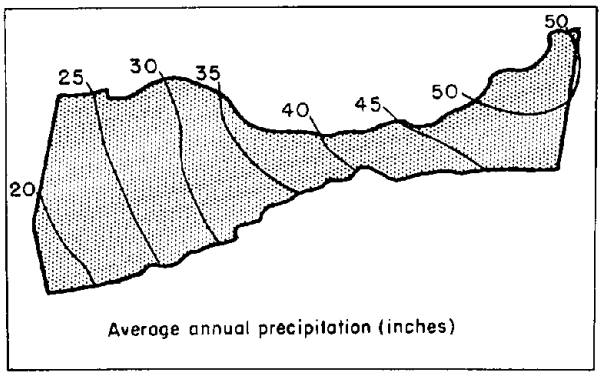
Season and station	Elevation	Temperature	Probability								
			1 in 10	2 in 10	3 in 10	4 in 10	5 in 10	6 in 10	7 in 10	8 in 10	9 in 10
In spring at—											
	Feet	°*F.*									
Camp Pardee	658	32	Mar. 18	Mar. 7	Feb. 27	Feb. 22	Feb. 16	Feb. 9	Feb. 3	Jan. 26	Jan. 15
		28	Feb. 26	Feb. 16	Feb. 7	Jan. 29	Jan. 20	(1)	(1)	(1)	(1)
Electra Powerhouse	715	32	Apr. 5	Mar. 29	Mar. 24	Mar. 20	Mar. 17	Mar. 13	Mar. 8	Mar. 3	Feb. 24
		28	Mar. 25	Mar. 15	Mar. 7	Feb. 28	Feb. 23	Feb. 17	Feb. 11	Feb. 2	Jan. 23
Ione	287	32	Apr. 3	Mar. 25	Mar. 19	Mar. 14	Mar. 9	Mar. 4	Feb. 27	Feb. 21	Feb. 11
		28	Mar. 6	Feb. 26	Feb. 20	Feb. 15	Feb. 11	Feb. 6	Jan. 31	Jan. 26	Jan. 17
Kennedy Mine	1, 500	32	Apr. 24	Apr. 10	Apr. 1	Mar. 24	Mar. 18	Mar. 9	Feb. 28	Feb. 18	Feb. 5
		28	Mar. 29	Mar. 8	Feb. 23	Feb. 10	Jan. 29	Jan. 18	Jan. 3	(1)	(1)
Salt Springs Powerhouse.	3, 700	32	May 17	May 8	May 3	Apr. 28	Apr. 23	Apr. 18	Apr. 13	Apr. 8	Mar. 30
		28	Apr. 20	Apr. 8	Apr. 2	Mar. 26	Mar. 19	Mar. 14	Mar. 7	Feb. 27	Feb. 16
Tiger Creek Powerhouse.	2, 355	32	May 26	May 17	May 12	May 7	May 2	Apr. 28	Apr. 23	Apr. 17	Apr. 8
		28	Apr. 6	Mar. 29	Mar. 26	Mar. 21	Mar. 18	Mar. 14	Mar. 9	Mar. 5	Feb. 26
In fall at—											
Camp Pardee	658	32	Nov. 12	Nov. 23	Dec. 3	Dec. 11	Dec. 20	Dec. 28	(2)	(2)	(2)
		28	Dec. 4	Dec. 14	Dec. 25	(2)	(2)	(2)	(2)	(2)	(2)
Electra Powerhouse	715	32	Oct. 25	Nov. 3	Nov. 8	Nov. 13	Nov. 18	Nov. 23	Nov. 28	Dec. 3	Dec. 11
		28	Nov. 8	Nov. 15	Nov. 22	Nov. 28	Dec. 4	Dec. 16	(2)	(2)	(2)
Ione	287	32	Nov. 5	Nov. 11	Nov. 14	Nov. 18	Nov. 21	Nov. 24	Nov. 27	Dec. 1	Dec. 5
		28	Nov. 13	Nov. 19	Nov. 24	Nov. 28	Dec. 3	Dec. 6	Dec. 11	Dec. 18	Dec. 28
Kennedy Mine	1, 500	32	Nov. 2	Nov. 9	Nov. 14	Nov. 20	Nov. 24	Dec. 1	Dec. 4	Dec. 11	Dec. 21
		28	Nov. 25	Nov. 30	Dec. 5	Dec. 12	Dec. 18	Dec. 24	Dec. 31	(2)	(2)
Salt Springs Powerhouse.	3, 700	32	Oct. 27	Nov. 2	Nov. 6	Nov. 10	Nov .14	Nov. 17	Nov. 20	Nov. 24	Dec. 1
		28	Nov. 9	Nov. 16	Nov. 22	Nov. 26	Dec. 2	Dec. 8	Dec. 13	Dec. 20	Dec. 29
Tiger Creek Powerhouse.	2, 355	32	Oct. 21	Oct. 26	Oct. 31	Nov. 3	Nov. 5	Nov. 8	Nov. 12	Nov. 15	Nov. 21
		28	Nov. 3	Nov. 11	Nov. 16	Nov. 20	Nov. 24	Nov. 29	Dec. 3	Dec. 8	Dec. 15

[1] Earlier than January 1.

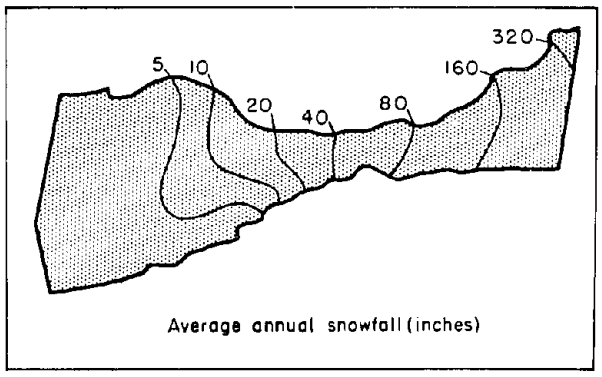
[2] Later than December 31.

TABLE 12.—*Probability of receiving total annual precipitation greater than indicated*

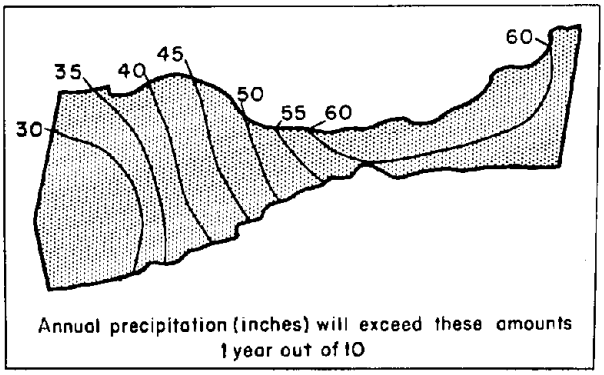
Station	Elevation	Probability (percent)								
		95	90	75	67	50	33	25	10	5
	Feet	*Inches*	*Inches*	*Inches*	*Inches*	*Inches*	*Inches*	*Inches*	*Inches*	*Inches*
Camp Pardee	658	12. 6	14. 0	16. 6	17. 7	19. 8	22. 0	23. 4	26. 9	29. 2
Electra Powerhouse	715	15. 4	18. 1	22. 9	24. 9	29. 4	33. 8	36. 5	44. 0	49. 4
Fiddletown, Lynch Ranch	2, 100	21. 4	24. 0	28. 8	30. 8	34. 9	39. 3	41. 7	48. 6	53. 2
Ione	287	12. 5	14. 0	16. 9	17. 9	20. 4	22. 9	24. 3	28. 4	31. 2
Jackson (near)	1, 900	20. 1	22. 8	27. 4	29. 5	33. 6	38. 2	40. 1	47. 8	52. 3
Kennedy Mine	1, 500	15. 8	18. 1	23. 0	24. 9	29. 4	32. 3	36. 3	43. 7	48. 4
Mokulmne Hill	1, 500	16. 1	20. 4	23. 5	25. 3	29. 2	34. 2	36. 9	44. 4	49. 4
Oleta	1, 510	22. 8	25. 3	29. 9	31. 8	35. 7	40. 1	42. 3	48. 8	53. 1
Plymouth	1, 096	17. 3	19. 2	22. 8	24. 1	27. 1	30. 2	32. 0	36. 7	40. 0
Salt Springs Powerhouse	3, 700	29. 0	32. 0	37. 5	39. 8	44. 1	49. 2	51. 8	59. 4	67. 1
Sloughhouse	160	11. 9	13. 3	15. 9	17. 0	19. 1	21. 5	22. 7	26. 4	28. 9
Sutter Hill Ranger Station	1, 580	17. 1	19. 1	22. 9	24. 4	27. 5	30. 9	32. 7	37. 9	41. 6
Tiger Creek Powerhouse	2, 355	22. 9	26. 7	33. 7	36. 7	43. 0	49. 8	53. 6	64. 4	71. 4
Wallace	197	11. 0	12. 4	15. 1	16. 2	18. 4	20. 9	22. 3	26. 2	28. 7
West Point	2, 840	22. 3	25. 3	28. 0	33. 3	37. 6	43. 3	46. 3	54. 6	59. 6
White Rock	353	11. 2	13. 1	17. 0	18. 7	22. 4	26. 0	28. 2	34. 7	39. 1



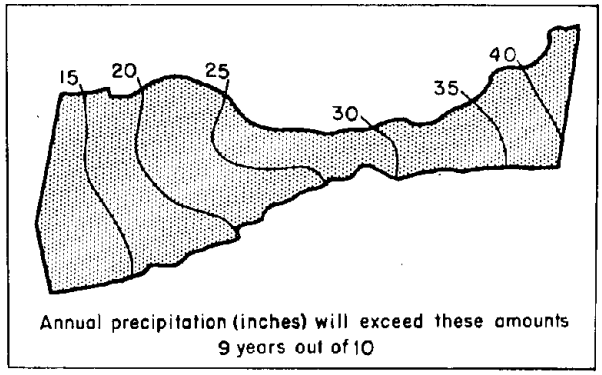
Average annual precipitation (inches)



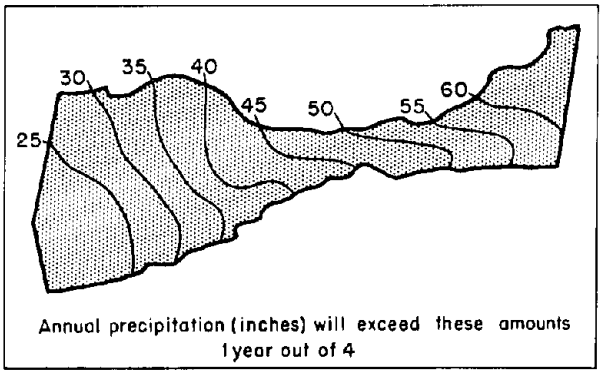
Average annual snowfall (inches)



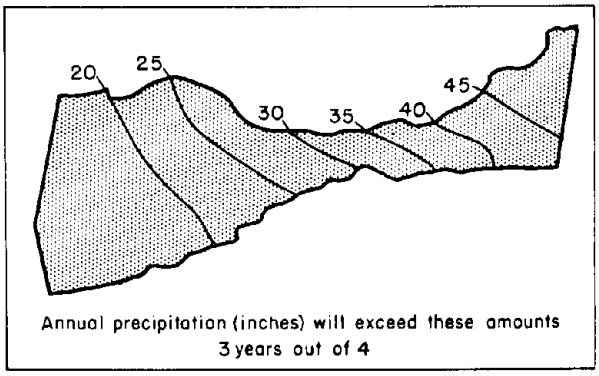
Annual precipitation (inches) will exceed these amounts 1 year out of 10



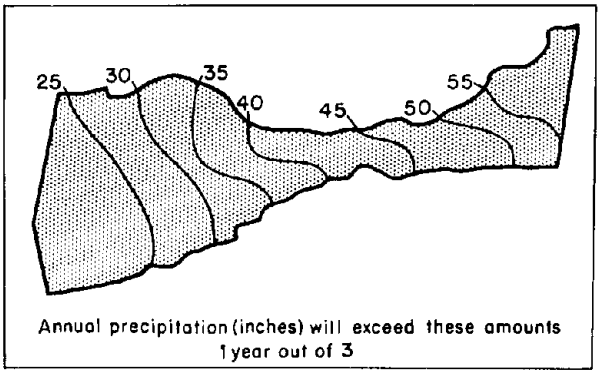
Annual precipitation (inches) will exceed these amounts 9 years out of 10



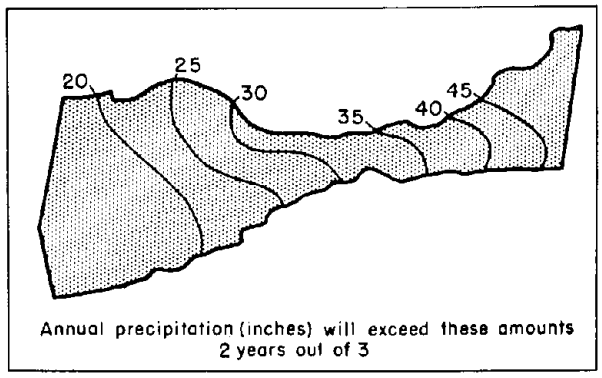
Annual precipitation (inches) will exceed these amounts 1 year out of 4



Annual precipitation (inches) will exceed these amounts 3 years out of 4



Annual precipitation (inches) will exceed these amounts 1 year out of 3



Annual precipitation (inches) will exceed these amounts 2 years out of 3

Figure 29.—**Precipitation in Amador Area and in adjoining areas.**

The average annual snowfall is about 15 inches at elevations of 2,500 feet and about 30 inches at the upper end of the Area, toward the east. At lower elevations, however, snowfall is infrequent and little accumulates.

Most precipitation in the Amador Area comes in fall, winter, and spring; only a small amount of moisture falls in summer. Storms in winter often cause heavy precipitation over the entire Area, but thundershowers in summer generally cover a limited area.

The average intensity of precipitation in 1 hour is likely to amount to as much as 0.5 to 0.7 of an inch every other year. The probability is that only once in a hundred years will the average intensity of precipitation in 1 hour be as much as 1.3 to 1.7 inches. The average intensity of precipitation in 6 hours ranges from 1.3 to 2.0 inches every 2 years and from 3.1 to 4.8 inches once in a hundred years. In a 24-hour period, an average precipitation of 2.1 to 4.0 inches can be expected every other year, and as much as 4.8 to 9.2 inches of precipitation can be expected once in a hundred years. The larger amounts are characteristic of areas at the higher elevations.

Soil moisture

Plant growth is related fairly directly to the amount of moisture used by the plant. This characteristic provides a convenient basis for computing estimated plant growth under various conditions. It is possible to compute the amount of moisture a plant could use under the existing climate if adequate water were available, and thus to estimate the potential growth of plants in the particular climate.

In the warmer part of the Amador Area a plant growing through the entire year could make use of about 36 inches of moisture if water were available. Plants whose growth is stopped by frost, however, would not be able to continue their growth throughout the year. Taking into account temperatures that stop plant growth, the potential use of moisture by plants in the warm areas might be limited to around 35 inches. Potential use would be less at high altitudes, as low as 30 inches for the year and 25 inches for the growing season. The values are called potential evapotranspiration (PET) and potential evapotranspiration for the growing season above 32 degrees (PET_{32}).

Where irrigation is not available, it is important to know potential plant development under dry-farmed conditions. If we assume that the soil is capable of storing 4 inches of available moisture in the root zone, a reasonable assumption for much of this Area, we find that hardy crops growing the year around would probably use 12 inches of moisture at low elevations and as much as 15 inches at higher elevations at the upper end of the Area. More moisture is available to plants during the growing season at higher elevations than in lower places. However, if we consider only the frost-free season, we find a potential plant use of 10 to 12 inches in the Area, about one-half to one-third of the potential evapotranspiration under irrigation. These values are called actual evapotranspiration (4Ea) and actual evapotranspiration for frost-free season ($4Ea_{32}$). The numeral 4 indicates that computations are based on 4 inches of available water capacity in the soil. Figure 30 shows calculated potential and actual evapotranspiration in different parts of the county for the growing season and for the entire year.

Wind

In general, the prevailing wind in the Amador Area blows from a westerly direction throughout the year, and windspeed averages less than 10 miles an hour. Locally there are occasional thundershowers in summer, and these are accompanied by damaging winds. Storms in winter generally come from a southwesterly direction. In winter, windspeed reaches 50 miles per hour approximately every 2 years, and as much as 90 miles per hour about once in 50 years.

Winds from the north and east blow over the lower west slopes of the Sierras from time to time. During the winter these winds bring cold, dry weather. In spring and summer, however, these winds are warm and dry. As a result, they quickly remove moisture from the soil surface and dry out plants.

Relative humidity and sunshine

Relative humidity in the Amador Area is moderate most of the time. In winter the average relative humidity is about 90 percent at night, but it drops to about 70 percent during the day. In summer relative humidity ranges from nearly 80 percent at night to 25 percent during the day. These generally low ratings are caused by downslope winds characteristic of the Area.

During the months of June through September, the sun shines more than 90 percent of the day, but in winter it shines only about 50 percent of the day. There is little difference in the amount of sunshine received from one part of the Area to another, except that in summer there are likely to be more clouds at the higher elevations.

Water Supplies

During the last half of the nineteenth century, the lower, western part of the county was well supplied with water by gravity through a labyrinth of mining ditches. Remnants of these ditches can still be seen on the sides of many hills. The network of ditches not only supplied water for mining and domestic use but also was a reliable source of water for irrigation (*22*).

The system of ditches was elaborate. Water was diverted from major streams and carried for miles around the hills on the contour. Many small dams and reservoirs were constructed to hold water from the ditches and to catch runoff from small watersheds. The system was difficult to maintain without constant care to prevent damage from landslides, levee breaks, and regrowth of vegetation. Consequently, when mining declined and money was not available for repairs, many of the ditches were abandoned. Some of the larger ditches were sold to utility companies for development of hydroelectric power and the sale of water for domestic purposes.

Today, the towns of Jackson, Sutter Creek, Ione, and Plymouth and the Preston School of Industry get their supply of domestic water from ditches. The Pardee Reservoir on the Mokelumne River, which has a surface area of 2,200 acres and a water-storage capacity of 208,600 acre-feet, supplies domestic water for cities in the eastern San Francisco Bay area.

In rural areas water for home use is generally obtained from springs or shallow wells. The supply of water for

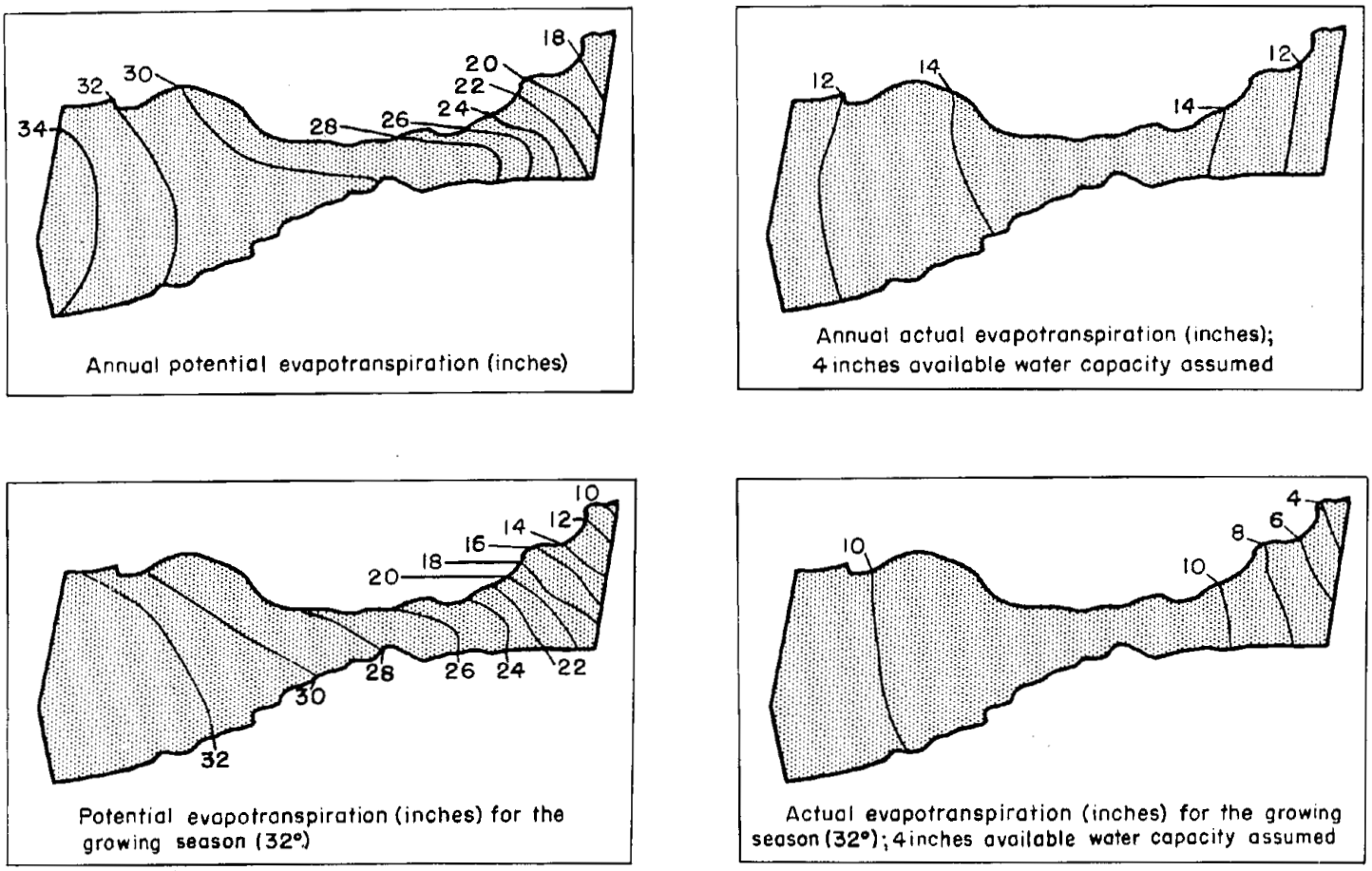


Figure 30.—**Potential and actual evapotranspiration in different parts of the county for the growing season and for the year. The average available water capacity is assumed to be 4 inches.**

domestic use is critical in many places after a series of dry years when rainfall is below normal.

The quality of the water is good in most areas. Water from ditches and from other surface sources, however, is turbid in spring during periods of heavy runoff. In some places in mountainous areas, the wells used for domestic purposes are high in iron salts. The iron salts discolor the water, but they are not harmful.

There are no large underground storage basins in the Area. In the hilly uplands, there are many small sites for reservoirs that are suitable for storing water for individual ranches. About 32 small reservoirs have been constructed, and they store about 1,600 acre-feet of water used mostly for irrigated pasture. On rangeland, numerous small ponds for watering stock have been constructed in areas of natural springs and in seep areas.

Lack of summer rainfall is one of the main factors limiting farming in Amador Area. Water for irrigation is scarce. In some places wells have been developed for irrigation near Dry Creek and in the alluvial bottom lands in the Jackson and Ione Valleys. In addition, a gas and electric company and a municipal utility district furnish some water to the Jackson Valley. The Jackson Valley Irrigation District has been formed to initiate group action for development of sources of irrigation water for the Jackson Valley area.

Because of the scarcity of water for irrigation, it is necessary to apply the water efficiently. In general, water for irrigation can be applied more evenly and efficiently on the sloping and hilly soils through sprinklers. Some of the nearly level soils, however, can be irrigated by use of furrows and borders.

Studies have been made to determine future needs of the Area and of adjoining mountain counties for water. They indicate that other sources of water are needed to supply adequate water to the Area for domestic and agricultural purposes (*8*). Plans for several projects are being considered. Also, at present, a 225,000 acre-foot reservoir is being constructed near Camanche below the present Pardee Reservoir. This reservoir will increase water storage of the East Bay Municipal Water District. Some of this water will be available for irrigation in the Amador Area.

Land and Its Ownership

About 20,000 acres of the southwestern part of the county were originally part of the Arroyo Seco Land Grant. This Mexican grant extended to the outskirts of the towns of Jackson and Sutter Creek. After much litigation over the Mexican claims, the grant was divided into several private ownerships. Much of the foothills of

the county was staked out as mining claims, and this is reflected in the present pattern of land ownership.

Today, almost 80 percent of the land in the county, or 302,830 acres, is still privately owned. About 70,000 acres in the eastern part of the county is in the Eldorado National Forest. Other Federal agencies occupy several thousand acres. A fairly large acreage adjoining the Pardee Reservoir is controlled by the municipal district that operates the utility.

Development and Population

Amador County was established in 1854 from Calaveras and El Dorado Counties. It was originally named Washington County, but the name was changed by the State Legislature to honor Jose Maria Amador, son of Pedro Amador, a Spanish soldier who settled in California in 1771. Approximately, the name Amador means "love of gold" in Spanish, for the county was largely settled by the forty-niners in search of gold.

Except for Ione, the major communities are along State Highway No. 49. According to the 1960 Census, Plymouth had a population of 489; Drytown a population of less than 200; Amador City a population of 202; Sutter Creek a population of 1,161; and Jackson, the county seat, a population of 1,852. Ione is about 8 miles west of Sutter Creek, and its population was 1,118. Other towns are Fiddletown, Volcano, Pine Grove, Pioneer, Buena Vista, and River Pines. The total population of the county in 1960 was 9,990.

Community Facilities

In most places in the Area, electricity, television, telephones, hospitals, shopping centers, bottled gas and oil for heating, and other modern conveniences are available. Three high schools are in the Area. There are also churches of many denominations and many social and business groups.

Pine forests, lakes, streams, and reservoirs provide recreation for people from local and surrounding areas the year around. They also provide seasonal vacation areas for others. In winter, a ski resort in the Eldorado National Forest serves enthusiasts of the sport. Old buildings and structures reminiscent of the gold-rush period attract many tourists.

Industries and Transportation

The major industry in the Area is concerned with development of hydroelectric power, which is generated mostly along the Mokelumne River. A network of dams, conduits, and powerhouses supplies most communities, homes, and industries with electricity. Next in importance is the lumbering industry. There are four sawmills operating in the county, but wood products from trees in the Area are manufactured in plants in nearby counties.

Agriculture and mining provide about equal amounts of income. The agriculture is centered around the production of livestock, mostly beef cattle. Mining products are derived mainly from nonmetallic minerals. Some of these are clay for refractories, silica sand for glass, lignite coal for wax, and stone for building. Production of gold is low at present.

Most transportation in the Area is by automobile and truck. A small busline operates out of the town of Jackson. The county airport is at Sutter Hill and has a paved runway of 2,000 feet.

Mined products, freight, lumber, and livestock are shipped by rail. Transportation for these products is provided by the Ione Branch of the Southern Pacific Lines and by the Amador Central Railroad, which connects with the Southern Pacific at Ione and extends to Martell.

Major towns and ranching communities are connected by highways, which are mostly of two lanes and are macadamized. State Highway No. 88 enters the southwest corner of the county, from Stockton, passes through Ione to Jackson, and then generally follows the Kit Carson Trail over the Sierra Nevada. State Highway No. 49 bisects the county from the north to the south at elevations from 1,000 to 1,500 feet. Other State highways furnish easy access to Sacramento and the Central Valley, and one of them, Highway No. 104, connects with U.S. Highway No. 99 near Galt. In the foothills, county roads make most ranches easily accessible. Mountain regions are traversed largely by secondary logging roads.

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GUIDE TO MAPPING UNITS, CAPABILITY UNITS, PASTURE AND RANGE SITES, AND WOODLAND SUITABILITY GROUPS

[See table 3, p. 28, for the Storie index rating of the soils and table 7, p. 67, for the approximate acreage and proportionate extent of each soil. For information significant to engineering, see section beginning on p. 45. Dashes in the pasture and range site and woodland suitability group columns indicate the soil has not been placed in one of these groupings because it is not suited to such use or is better suited to other uses.

Map symbol	Mapping unit	Page	Capability unit		Pasture and range site		Woodland suitability group	
			Symbol	Page	Number	Page	Number	Page
AaB	Ahwahnee loam, 3 to 9 percent slopes	84	IIIe-8(18)	17	3	35	--	
AaB2	Ahwahnee loam, 3 to 9 percent slopes, eroded	85	IIIe-8(18)	17	3	35	--	
AaC	Ahwahnee loam, 9 to 16 percent slopes	85	IVe-8(18)	20	3	35	--	
AaC2	Ahwahnee loam, 9 to 16 percent slopes, eroded	85	IVe-8(18)	20	3	35	--	
AaD	Ahwahnee loam, 16 to 31 percent slopes	85	VIe-1(18)	22	3	35	--	
AaD2	Ahwahnee loam, 16 to 31 percent slopes, eroded	85	VIe-1(18)	22	3	35	--	
AdD	Ahwahnee very rocky loam, 9 to 31 percent slopes	84	VIs-1(18)	23	3	35	--	
AdD3	Ahwahnee very rocky loam, 16 to 31 percent slopes, severely eroded	86	VIIs-1(18)	25	3	35	--	
AdE	Ahwahnee very rocky loam, 31 to 51 percent slopes	86	VIIs-1(18)	25	3	35	--	
AeE	Ahwahnee very rocky loam, shallow, 16 to 51 percent slopes	86	VIs-49(18)	24	6	37	--	
AfD	Ahwahnee extremely rocky loam, 9 to 51 percent slopes	86	VIIs-7(18)	26	5	36	--	
AhB	Aiken loam, 3 to 9 percent slopes	87	IIe-1(22)	15	--		1	41
AhC	Aiken loam, 9 to 16 percent slopes	87	IIIe-1(22)	17	--		1	41
AkC	Aiken cobbly loam, 3 to 16 percent slopes	86	IVs-7(22)	22	--		1	41
AkD	Aiken cobbly loam, 16 to 31 percent slopes	87	VIs-1(22)	23	--		2	41
AkE	Aiken cobbly loam, 31 to 51 percent slopes	87	VIs-1(22)	23	--		3	42
AmE	Aiken very rocky loam, 16 to 51 percent slopes	87	VIs-1(22)	23	--		3	42
AmF	Aiken very rocky loam, 51 to 71 percent slopes	88	VIIs-1(22)	26	--		4	42
AnD	Argonaut gravelly loam, 3 to 31 percent slopes	88	IVe-3(18)	19	2	33	--	
AoD	Argonaut very rocky loam, 3 to 31 percent slopes	88	VIs-4(18)	23	2	33	--	
ApD	Auburn silt loam, 0 to 31 percent slopes	89	IVe-4(18)	20	2	33	--	
ArC	Auburn silt loam, moderately deep, 3 to 16 percent slopes	89	IIIe-8(18)	17	1	33	--	
ArD	Auburn silt loam, moderately deep, 16 to 31 percent slopes	90	IVe-8(18)	20	1	33	--	
AsB2	Auburn very rocky silt loam, 3 to 9 percent slopes, eroded	89	VIs-4(18)	23	2	33	--	
AsD	Auburn very rocky silt loam, 3 to 31 percent slopes	89	VIs-4(18)	23	2	33	--	
AsE	Auburn very rocky silt loam, 31 to 51 percent slopes	89	VIs-41(18)	24	2	33	--	
AtD	Auburn very rocky silt loam, moderately deep, 3 to 31 percent slopes	90	VIs-8(18)	24	1	33	--	
AtE	Auburn very rocky silt loam, moderately deep, 31 to 51 percent slopes	90	VIs-81(18)	25	1	33	--	
AuD	Auburn extremely rocky silt loam, 3 to 31 percent slopes	89	VIIs-7(18)	26	5	36	--	
AuF	Auburn extremely rocky silt loam, 31 to 71 percent slopes	89	VIIs-7(18)	26	5	36	--	
AvE	Auburn extremely rocky silt loam, moderately deep, 31 to 71 percent slopes	90	VIIs-7(18)	26	5	36	--	
AwC	Auburn-Argonaut silt loams, 0 to 16 percent slopes	90						
	Auburn silt loam, 0 to 16 percent slopes	--	IIIe-8(18)	17	2	33	--	
	Argonaut silt loam, 0 to 16 percent slopes	--	IIIe-8(18)	17	2	33	--	

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Map symbol	Mapping unit	Page	Capability unit		Pasture and range site		Woodland suitability group	
			Symbol	Page	Number	Page	Number	Page
AxD	Auburn-Argonaut very rocky silt loams, 3 to 31 percent slopes	90						
	Auburn very rocky silt loam, 3 to 31 percent slopes	--	VIs-8(18)	24	2	33	--	
	Argonaut very rocky silt loam, 3 to 31 percent slopes	--	VIs-8(18)	24	2	33	--	
CaC	Cohasset loam, 5 to 16 percent slopes	91	IIIe-1(22)	17	--		1	41
CaD	Cohasset loam, 16 to 31 percent slopes	91	IVe-1(22)	19	--		3	42
CbC	Cohasset very cobbly loam, 3 to 16 percent slopes	91	Vs-7(22)	22	--		1	41
CbE	Cohasset very cobbly loam, 16 to 51 percent slopes	90	VIs-1(22)	23	--		3	42
CbF	Cohasset very cobbly loam, 51 to 71 percent slopes	91	VIIs-1(22)	26	--		4	42
CcC	Cohasset very cobbly loam, moderately deep, 3 to 16 percent slopes	91	VIs-8(22)	25	--		5	42
CcE	Cohasset very cobbly loam, moderately deep, 16 to 51 percent slopes	91	VIs-81(22)	25	--		7	43
CoC	Cohasset very cobbly sandy loam, 3 to 16 percent slopes	91	Vs-7(22)	22	--		1	41
CoE	Cohasset very cobbly sandy loam, 16 to 51 percent slopes	91	VIs-1(22)	23	--		3	42
EcD	Exchequer very rocky silty loam, 3 to 31 percent slopes	92	VIIs-4(18)	26	9	38	--	
EcE	Exchequer very rocky silt loam, 31 to 51 percent slopes	92	VIIs-4(18)	26	9	38	--	
EhD	Exchequer and Auburn loams, 3 to 31 slopes	92						
	Exchequer loam, 3 to 31 percent slopes	--	VIs-4(18)	23	2	33	--	
	Auburn loam, 3 to 31 percent slopes	--	IVe-4(18)	20	2	33	--	
ExD	Exchequer and Auburn very rocky loams, 3 to 31 percent slopes	93						
	Exchequer very rocky loam, 3 to 31 percent slopes	--	VIIs-4(18)	26	9	38	--	
	Auburn very rocky loam, 3 to 31 percent slopes	--	VIs-4(18)	23	2	33	--	
ExE	Exchequer and Auburn very rocky loams, 31 to 51 percent slopes	93						
	Exchequer very rocky loam, 31 to 51 percent slopes	--	VIIs-4(18)	26	9	38	--	
	Auburn very rocky loam, 31 to 51 percent slopes	--	VIs-41(18)	24	2	33	--	
FdC	Fiddletown gravelly loam, 9 to 16 percent slopes	94	IIIe-8(22)	17	--		5	42
FdD	Fiddletown gravelly loam, 16 to 31 percent slopes	94	IVe-8(22)	20	--		6	43
FgB	Fiddletown gravelly loam, deep, 3 to 10 percent slopes	93	IIe-1(22)	15	--		1	41
FoE	Fiddletown very rocky loam, 16 to 51 percent slopes	93	VIs-1(22)	23	--		7	43
FoF	Fiddletown very rocky loam, 51 to 71 percent slopes	94	VIIs-81(22)	27	--		8	43
FtE	Fiddletown very rocky loam, deep, 16 to 51 percent slopes	94	VIs-1(22)	23	--		3	42
HaD	Henneke very rocky loam, 3 to 51 percent slopes	94	VIIs-9(18)	27	7	37	--	

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Map symbol	Mapping unit	Page	Capability unit		Pasture and range site		Woodland suitability group	
			Symbol	Page	Number	Page	Number	Page
HcC	Holland coarse sandy loam, 5 to 9 percent slopes	96	IIIe-8(22)	17	--		6	43
HcD	Holland coarse sandy loam, 9 to 16 percent slopes	96	IVe-8(22)	20	--		6	43
HcE	Holland coarse sandy loam, 16 to 36 percent slopes	96	VIs-81(22)	25	--		8	43
HdC	Holland coarse sandy loam, deep, 5 to 9 percent slopes	95	IIIe-1(22)	17	--		2	41
HdD	Holland coarse sandy loam, deep, 9 to 16 percent slopes	95	IVe-1(22)	19	--		2	41
HfD	Holland very rocky coarse sandy loam, 9 to 16 percent slopes	96	VIs-8(22)	25	--		7	43
HfE	Holland very rocky coarse sandy loam, 16 to 51 percent slopes	96	VIs-81(22)	25	--		8	43
HfF	Holland very rocky coarse sandy loam, 51 to 71 percent slopes	96	VIIs-81(22)	27	--		8	43
HkE	Holland very rocky coarse sandy loam, deep, 16 to 51 percent slopes	96	VIs-1(22)	23	--		4	42
Hm	Honcut clay loam, over clay	98	IIIw-3(18)	18	1	33	--	
Hn	Honcut silt loam	97	I-1(18)	14	1	33	--	
Ho	Honcut very fine sandy loam	97	I-1(18)	14	1	33	--	
Hs	Honcut very fine sandy loam, moderately well drained	97	IIw-2(18)	16	1	33	--	
Hv	Honcut very fine sandy loam, channeled	97	IVw-2(18)	21	1	33	--	
IdC	Inks loam, deep variant, 3 to 16 percent slopes	98	IIIe-8(18)	17	1	33	--	
IrE	Inks loam and Rock land, 3 to 45 percent slopes	98						
	Inks loam, 3 to 45 percent slopes	--	VIIs-4(18)	26	8	38	--	
	Rock land	--	VIIIs-8(18)	27	--		--	
IsE	Iron Mountain very stony loam, 9 to 51 percent slopes	99	VIIs-4(18), VIIs-4(22)	26 26	8	38	9	44
IvE	Iron Mountain very stony loam, rhyolite substratum, 9 to 51 percent slopes	99	VIs-4(22)	24	--		9	44
JgE	Jiggs very rocky loam, 16 to 51 percent slopes	100	VIs-81(22)	25	--		8	43
JmC	Josephine loam, 3 to 16 percent slopes	101	IIIe-8(22)	17	--		5	42
JmD	Josephine loam, 16 to 31 percent slopes	102	IVe-8(22)	20	--		6	43
JmE	Josephine loam, 31 to 51 percent slopes	102	VIs-81(22)	25	--		6	43
JnC	Josephine loam, deep, 9 to 16 percent slopes	101	IIIe-1(22)	17	--		1	41
JnD	Josephine loam, deep, 16 to 31 percent slopes	101	IVe-1(22)	19	--		3	42
JnE	Josephine loam, deep, 31 to 51 percent slopes	101	VIs-1(22)	23	--		3	42
JoC	Josephine very rocky loam, 3 to 16 percent slopes	102	VIs-8(22)	25	--		5	42
JoE	Josephine very rocky loam, 16 to 51 percent slopes	100	VIs-81(22)	25	--		7	43
JoF	Josephine very rocky loam, 51 to 71 percent slopes	102	VIIs-81(22)	27	--		8	43
JpE	Josephine very rocky loam, deep, 16 to 51 percent slopes	101	VIs-1(22)	23	--		3	42
JpF	Josephine very rocky loam, deep, 51 to 71 percent slopes	101	VIIs-1(22)	26	--		4	42
JsE	Josephine-Maymen complex, 16 to 51 percent slopes	102						
	Josephine very rocky loam, 16 to 51 percent slopes	--	VIs-81(22)	25	--		7	43
	Maymen very rocky loam, 16 to 51 percent slopes	--	VIIs-4(22)	26	--		9	44

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Map symbol	Mapping unit	Page	Capability unit		Pasture and range site		Woodland suitability group	
			Symbol	Page	Number	Page	Number	Page
JxE	Josephine-Mariposa complex, 16 to 51 percent slopes	102						
	Josephine very rocky loam, 16 to 51 percent slopes	---	VIs-81(22)	25	--		7	43
	Mariposa very rocky loam, 31 to 51 percent slopes	---	VIs-4(22)	24	--		9	44
JxF	Josephine-Mariposa complex, 51 to 71 percent slopes	102						
	Josephine very rocky loam, 51 to 71 percent slopes	---	VIIs-81(22)	27	--		8	43
	Mariposa very rocky loam, 51 to 71 percent slopes	---	VIIs-81(22)	27	--		9	44
LaC	Laniger sandy loam, 2 to 16 percent slopes	102	IVe-8(18)	20	6	37	--	
LgB	Laniger sandy loam, thick surface, 0 to 5 percent slopes	103	IIIw-3(18)	18	6	37	--	
Ln	Limestone rock land	103	VIIIs-8(22)	27	--		--	
Lo	Loamy alluvial land	103	IIe-1(22)	15	1	33	1	41
Ma	Made land	103	IVe-39(18)	19	4	36	--	
MbD	Mariposa gravelly loam, 3 to 31 percent slopes	104	IVe-84(22)	21	--		9	44
McD	Mariposa very rocky loam, 9 to 31 percent slopes	104	VIs-4(22)	24	--		9	44
McE	Mariposa very rocky loam, 31 to 51 percent slopes	104	VIs-4(22)	24	--		9	44
McF	Mariposa very rocky loam, 51 to 85 percent slopes	105	VIIs-41(22)	26	--		9	44
MdE	Mariposa-Maymen complex, 16 to 51 percent slopes	105						
	Mariposa very rocky loam, 16 to 51 percent slopes	---	VIs-4(22)	24	--		9	44
	Maymen very rocky loam, 16 to 51 percent slopes	---	VIIs-4(22)	26	--		9	44
MdF	Mariposa-Maymen complex, 51 to 85 percent slopes	105						
	Mariposa very rocky loam, 51 to 85 percent slopes	---	VIIs-41(22)	26	--		9	44
	Maymen very rocky loam, 51 to 85 percent slopes	---	VIIs-41(22)	26	--		9	44
MgE	Maymen very rocky loam, 9 to 51 percent slopes	105	VIIs-4(22)	26	--		9	44
MhE	Maymen-Mariposa complex, 16 to 51 percent slopes	105						
	Maymen very rocky loam, 16 to 51 percent slopes	---	VIIs-4(22)	26	--		9	44
	Mariposa very rocky loam, 16 to 51 percent slopes	---	VIs-4(22)	24	--		9	44
MkE	McCarthy very rocky loam, 16 to 51 percent slopes	106	VIs-1(22)	23	--		3	42
MkF	McCarthy very rocky loam, 51 to 71 percent slopes	106	VIIs-1(22)	26	--		4	42
MlC	McCarthy very cobbly loam, 3 to 16 percent slopes	105	VIs-8(22)	25	--		5	42
MmE	McCarthy and Jiggs very cobbly loams, 16 to 51 percent slopes	106						
	McCarthy very cobbly loam, 16 to 51 percent slopes	---	VIs-81(22)	25	--		7	43
	Jiggs very cobbly loam, 16 to 51 percent slopes	---	VIs-1(22)	23	--		8	43

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Map symbol	Mapping unit	Page	Capability unit		Pasture and range site		Woodland suitability group	
			Symbol	Page	Number	Page	Number	Page
Mn	Mine tailings and Riverwash	106	VIIIs-8(18), VIIIs-8(22)	27 27	27		--	
Mo	Mixed alluvial land	106	IVw-2(18), IVw-2(22)	21 21	1	33	1	41
Mp	Mixed wet alluvial land	107	IVw-2(18), IVw-2(22)	21 21	1	33	1	41
MrB	Mokelumne sandy loam, 2 to 5 percent slopes	107	IVe-39(18)	19	4	36	--	
MsD	Mokelumne coarse sandy loam, 5 to 36 percent slopes	108	VIe-9(18)	23	4	36	--	
Mt	Mokelumne soils and Alluvial land	108						
	Mokelumne sandy loam, 2 to 5 percent slopes	---	IVe-39(18)	19	4	36	--	
	Alluvial land	---	IVw-2(18)	21	1	33	--	
MuB	Musick sandy loam, 3 to 9 percent slopes	109	IIIe-1(22)	17	--		2	41
MuC	Musick sandy loam, 9 to 16 percent slopes	109	IVe-1(22)	19	--		2	41
MuD	Musick sandy loam, 16 to 31 percent slopes	109	VIs-1(22)	23	--		4	42
MuE	Musick sandy loam, 31 to 51 percent slopes	109	VIs-1(22)	23	--		4	42
MvC	Musick very rocky sandy loam, 9 to 16 percent slopes	109	Vs-7(22)	22	--		2	41
MvE	Musick very rocky sandy loam, 16 to 51 percent slopes	109	VIs-1(22)	23	--		4	42
MvF	Musick very rocky sandy loam, 51 to 71 percent slopes	110	VIIs-1(22)	26	--		4	42
MwE	Musick very rocky sandy loam, moderately deep, 16 to 51 percent slopes	110	VIs-81(22)	25	--		8	43
MwF	Musick very rocky sandy loam, moderately deep, 51 to 71 percent slopes	110	VIIs-81(22)	27	--		8	43
MxF	Musick extremely rocky sandy loam, moderately deep, 51 to 71 percent slopes	110	VIIs-81(22)	27	--		8	43
PaD	Pardee cobbly loam, 3 to 31 percent slopes	110	VIe-9(18)	23	4	36	--	
PnC	Pentz sandy loam, 2 to 16 percent slopes	111	VIs-49(18)	24	6	37	--	
PnC2	Pentz sandy loam, 9 to 16 percent slopes, eroded	112	VIs-49(18)	24	6	37	--	
PnD	Pentz sandy loam, 16 to 31 percent slopes	112	VIs-49(18)	24	6	37	--	
PoE	Pentz sandy loam, very shallow, 2 to 51 percent slopes	112	VIIs-4(18)	26	8	38	--	
PpC	Pentz gravelly sandy loam, 2 to 16 percent slopes	112	VIs-49(18)	24	6	37	--	
PrA	Perkins loam, 0 to 3 percent slopes	112	IIIs-3(18)	18	1	33	--	
PrC	Perkins loam, 3 to 16 percent slopes	113	IIIe-3(18)	17	1	33	--	
PtB	Peters clay, 3 to 9 percent slopes	113	IVe-3(18)	19	4	36	--	
Pw	Placer diggings and Riverwash	113	VIIs-0(18) and 22)	27	10	38	--	
RbB	Red Bluff-Mokelumne complex, 0 to 5 percent slopes	114						
	Red Bluff gravelly loam, 0 to 5 percent slopes	---	IVe-39(18)	19	4	36	--	
	Mokelumne gravelly sandy loam, 0 to 5 percent slopes	--	IVe-39(18)	19	4	36	--	
RbD	Red Bluff-Mokelumne complex, 5 to 16 percent slopes	114						
	Red Bluff gravelly loam, 5 to 16 percent slopes	---	IVe-39(18)	19	4	36	--	
	Mokelumne gravelly sandy loam, 5 to 16 percent slopes	--	IVe-39(18)	19	4	36	--	
RbE2	Red Bluff-Mokelumne complex, 16 to 36 percent slopes, eroded	114						
	Red Bluff gravelly loam, 16 to 36 percent slopes, eroded	---	VIe-9(18)	23	4	36	--	
	Mokelumne gravelly sandy loam, 16 to 36 percent slopes, eroded	---	VIe-9(18)	23	4	36	--	

GUIDE TO MAPPING UNITS, CAPABILITY UNITS, PASTURE AND RANGE SITES, AND WOODLAND SUITABILITY GROUPS--Continued

Map symbol	Mapping unit	Page	Capability unit		Pasture and range site		Woodland suitability group	
			Symbol	Page	Number	Page	Number	Page
RmD	Red Bluff-Mokelumne-Mine pits complex, 2 to 16 percent slopes	114						
	Red Bluff gravelly loam, 2 to 16 percent slopes	---	IVe-39(18)	19	4	36	--	
	Mokelumne gravelly sandy loam, 2 to 16 percent slopes	---	IVe-39(18)	19	4	36	--	
	Mine pits	---	VIIIs-8(18)	27	--		--	
Ro	Rock land	115	VIIIs-8(18), VIIIs-8(22)	27	--		--	
RvA	Ryer silty clay loam, 0 to 3 percent slopes	115	IIIs-3(18)	18	1	33	--	
Sa	Sedimentary rock land	115	VIIIs-8(18)	27	--		--	
Sb	Serpentine rock land	115	VIIIs-8(18)	27	--		--	
ScF	Shaver very rocky coarse sandy loam, 51 to 71 percent slopes	116	VIIs-1(22)	26	--		4	42
SdF	Shaver very rocky coarse sandy loam, moderately deep, 51 to 71 percent slopes	116	VIIs-81(22)	27	--		8	43
SfB	Shenandoah loam, 3 to 9 percent slopes	116	IIIw-3(18)	18	3	35	--	
SgB	Sierra coarse sandy loam, 3 to 9 percent slopes	117	IIIe-1(18)	16	3	35	--	
SgB2	Sierra coarse sandy loam, 3 to 9 percent slopes, eroded	118	IIIe-1(18)	16	3	35	--	
SgC	Sierra coarse sandy loam, 9 to 16 percent slopes	117	IVe-1(18)	18	3	35	--	
SgC2	Sierra coarse sandy loam, 9 to 16 percent slopes, eroded	118	IVe-1(18)	18	3	35	--	
SgD	Sierra coarse sandy loam, 16 to 31 percent slopes	118	VIe-1(18)	22	3	35	--	
SgD2	Sierra coarse sandy loam, 16 to 31 percent slopes, eroded	118	VIe-1(18)	22	3	35	--	
ShB	Sierra coarse sandy loam, moderately deep, 3 to 9 percent slopes	119	IIIe-8(18)	17	3	35	--	
ShB2	Sierra coarse sandy loam, moderately deep, 3 to 9 percent slopes, eroded	119	IIIe-8(18)	17	3	35	--	
ShC	Sierra coarse sandy loam, moderately deep, 9 to 16 percent slopes	119	IVe-8(18)	20	3	35	--	
ShC2	Sierra coarse sandy loam, moderately deep, 9 to 16 percent slopes, eroded	119	IVe-8(18)	20	3	35	--	
ShD	Sierra coarse sandy loam, moderately deep, 16 to 31 percent slopes	119	VIe-1(18)	22	3	35	--	
ShD2	Sierra coarse sandy loam, moderately deep, 16 to 31 percent slopes, eroded	119	VIe-1(18)	22	3	35	--	
SkD	Sierra very rocky coarse sandy loam, 16 to 31 percent slopes	118	VIs-1(18)	23	3	35	--	
SkF	Sierra very rocky coarse sandy loam, 51 to 71 percent slopes	118	VIIs-1(18)	25	3	35	--	
SlD3	Sierra sandy clay loam, 9 to 31 percent slopes, severely eroded	120	VIIs-1(18)	25	3	35	--	
SmD	Sierra very rocky coarse sandy loam, moderately deep, 9 to 31 percent slopes	120	VIs-1(18)	23	3	35	--	
SmE	Sierra very rocky coarse sandy loam, moderately deep, 31 to 51 percent slopes	120	VIIs-1(18)	25	3	35	--	
SnB	Sites loam, 3 to 9 percent slopes	121	IIe-1(22)	15	--		1	41
SnC	Sites loam, 9 to 16 percent slopes	121	IIIe-1(22)	17	--		1	41
SnD	Sites loam, 16 to 31 percent slopes	121	IVe-1(22)	19	--		3	42
SnE	Sites loam, 31 to 51 percent slopes	121	VIs-1(22)	23	--		3	42
SoC	Sites loam, moderately deep, 3 to 16 percent slopes	122	IIIe-8(22)	17	--		5	42
SoD	Sites loam, moderately deep, 16 to 31 percent slopes	122	IVe-8(22)	20	--		6	43

GUIDE TO MAPPING UNITS, CAPABILITY UNITS, PASTURE AND RANGE SITES, AND WOODLAND SUITABILITY GROUPS--Continued

Map symbol	Mapping unit	Page	Capability unit		Pasture and range site		Woodland suitability group	
			Symbol	Page	Number	Page	Number	Page
SoE	Sites loam, moderately deep, 31 to 51 percent slopes	122	VIs-81(22)	25	--		6	43
SpD3	Sites clay loam, moderately deep, 3 to 31 percent slopes, severely eroded	122	IVe-8(22)	20	--		6	43
SrC	Sites very rocky loam, 3 to 16 percent slopes	122	Vs-7(22)	22	--		1	41
SrE	Sites very rocky loam, 16 to 51 percent slopes	120	VIs-1(22)	23	--		3	42
SrF	Sites very rocky loam, 51 to 85 percent slopes	122	VIIs-1(22)	26	--		4	42
SsE	Sites very rocky loam, moderately deep, 16 to 51 percent slopes	123	VIs-81(22)	25	--		7	43
StE	Sites-Mariposa complex, 16 to 51 percent slopes	123						
	Sites very rocky loam, moderately deep, 16 to 51 percent slopes	---	VIs-81(22)	25	--		7	43
	Mariposa very rocky loam, 16 to 51 percent slopes	--	VIs-4(22)	24	--		9	44
SuB	Snelling loam, moderately well drained, 0 to 9 percent slopes	124	IIw-2(18)	16	3	35	--	
SvA	Snelling fine sandy loam, 0 to 2 percent slopes	124	I-1(18)	14	3	35	--	
SvB	Snelling fine sandy loam, 2 to 5 percent slopes	124	IIIe-1(18)	16	3	35	--	
SvC	Snelling fine sandy loam, 5 to 9 percent slopes	124	IIIe-1(18)	16	3	35	--	
SwD	Snelling sandy loam, 9 to 16 percent slopes	123	IVe-1(18)	18	3	35	--	
SwE	Snelling sandy loam, 16 to 31 percent slopes	123	VIe-1(18)	22	3	35	--	
SxD	Supan cobbly loam, 3 to 31 percent slopes	125	IVs-7(18)	22	1	33	--	
SyD	Supan very cobbly loam, moderately deep, 3 to 31 percent slopes	125	VIs-8(18)	24	1	33	--	
SyE	Supan very cobbly loam, moderately deep, 31 to 51 percent slopes	125	VIs-81(18)	25	1	33	--	
TcE	Tiger Creek very rocky loam, 16 to 51 percent slopes	126	VIs-81(22)	25	--		7	43
WcD	Windy cobbly sandy loam, 9 to 16 percent slopes	127	VIs-8(22)	25	--		5	42
WcE	Windy cobbly sandy loam, 16 to 51 percent slopes	126	VIs-81(22)	25	--		7	43

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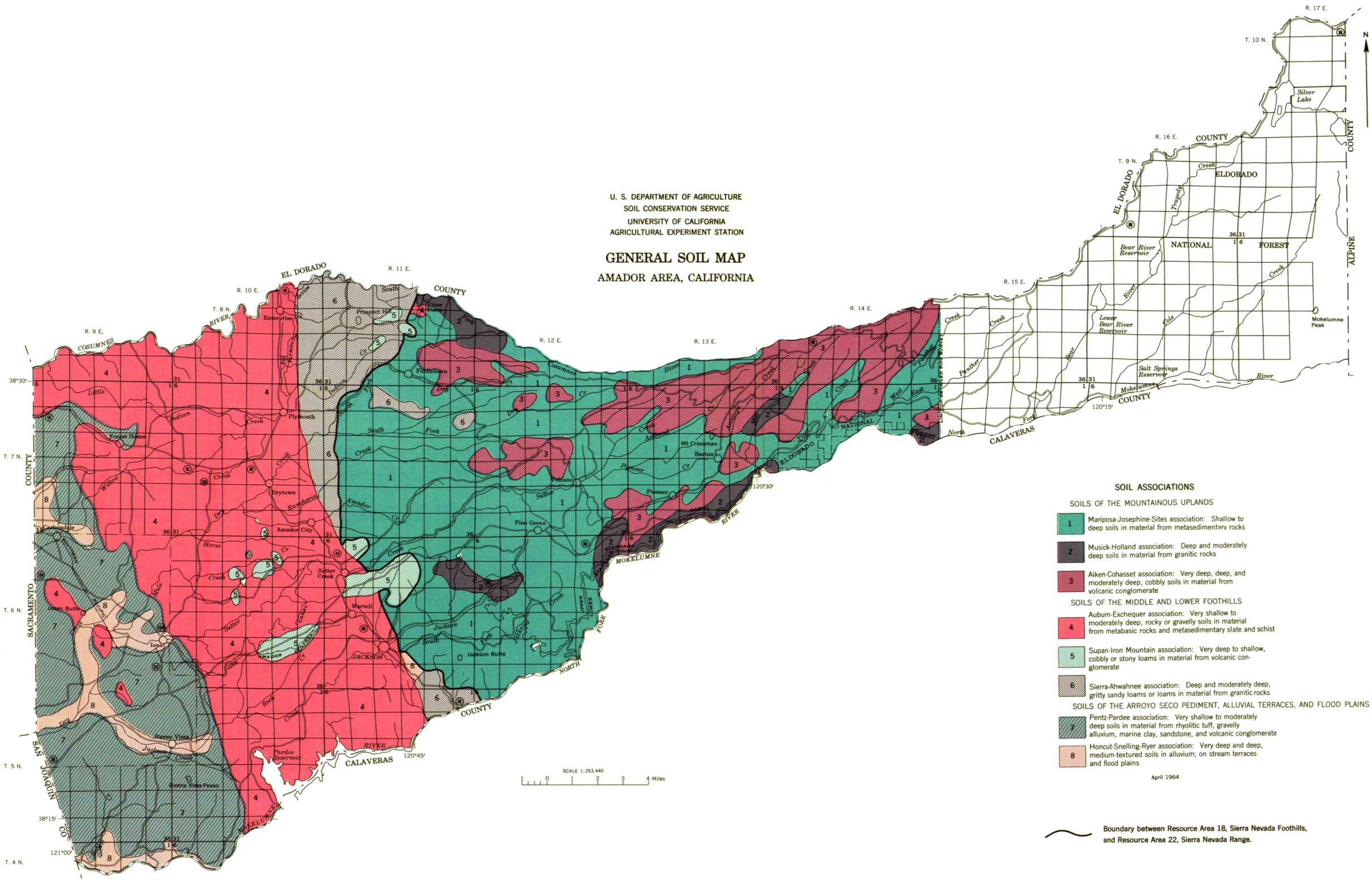
U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
UNIVERSITY OF CALIFORNIA
AGRICULTURAL EXPERIMENT STATION

GENERAL SOIL MAP

AMADOR AREA, CALIFORNIA



SOIL ASSOCIATIONS

SOILS OF THE MOUNTAINOUS UPLANDS

1 Mariposa-Josephine-Sites association: Shallow to deep soils in material from metasedimentary rocks

2 Musick-Holland association: Deep and moderately deep soils in material from granitic rocks

3 Aiken-Cohasset association: Very deep, deep, and moderately deep, cobbly soils in material from volcanic conglomerate

SOILS OF THE MIDDLE AND LOWER FOOTHILLS

4 Auburn-Exchequer association: Very shallow to moderately deep, rocky or gravelly soils in material from metabasic rocks and metasedimentary slate and schist

5 Supan-Iron Mountain association: Very deep to shallow, cobbly or stony loams in material from volcanic conglomerate

6 Sierra-Ahwahnee association: Deep and moderately deep, gritty sandy loams or loams in material from granitic rocks

SOILS OF THE ARROYO SECO PEDIMENT, ALLUVIAL TERRACES, AND FLOOD PLAINS

7 Pentz-Pardee association: Very shallow to moderately deep soils in material from rhyolitic tuff, gravelly alluvium, marine clay, sandstone, and volcanic conglomerate

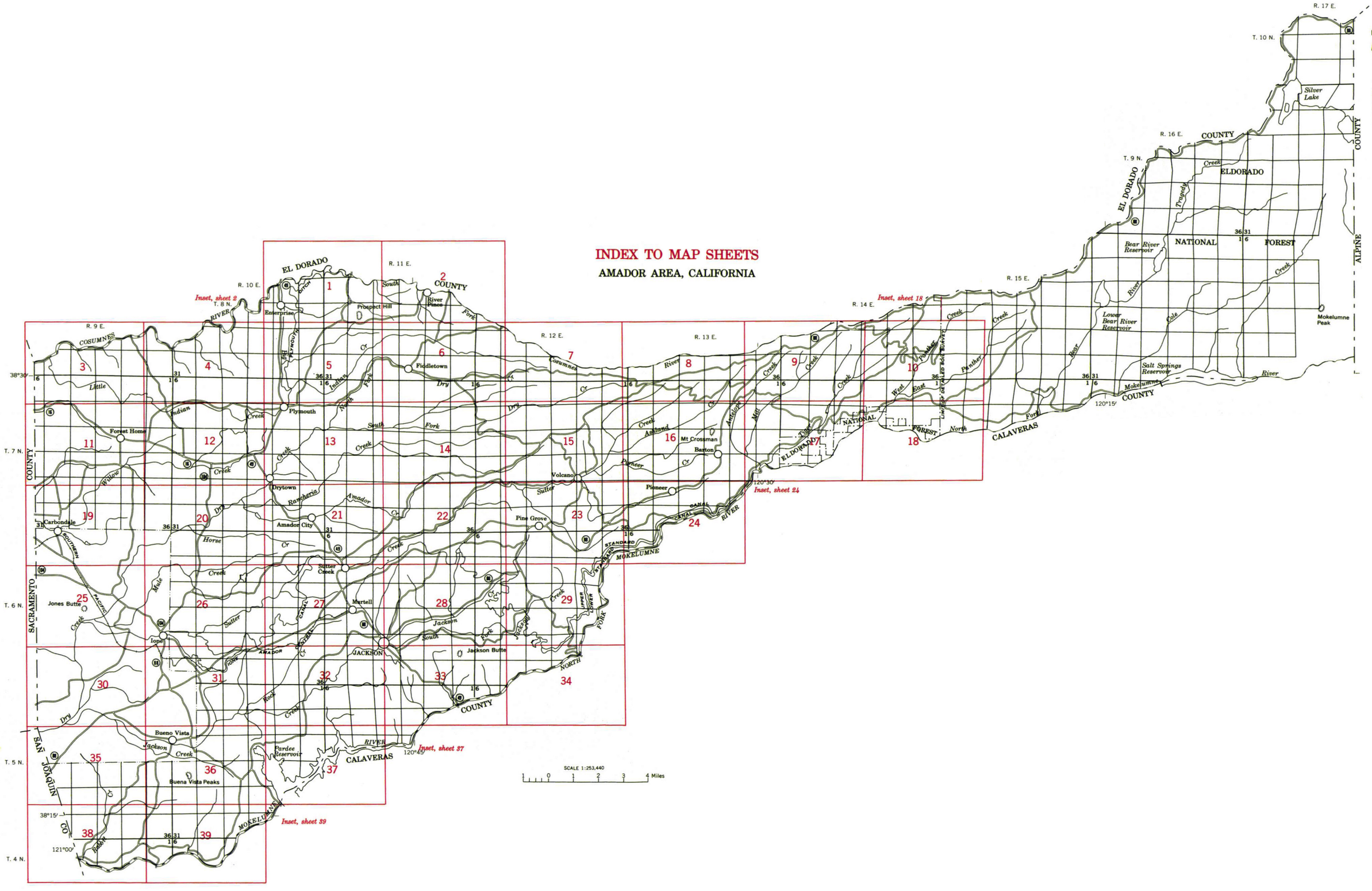
8 Honcut-Snelling-Ryer association: Very deep and deep, medium-textured soils in alluvium; on stream terraces and flood plains

April 1964

Boundary between Resource Area 18, Sierra Nevada Foothills, and Resource Area 22, Sierra Nevada Range.

INDEX TO MAP SHEETS

AMADOR AREA, CALIFORNIA



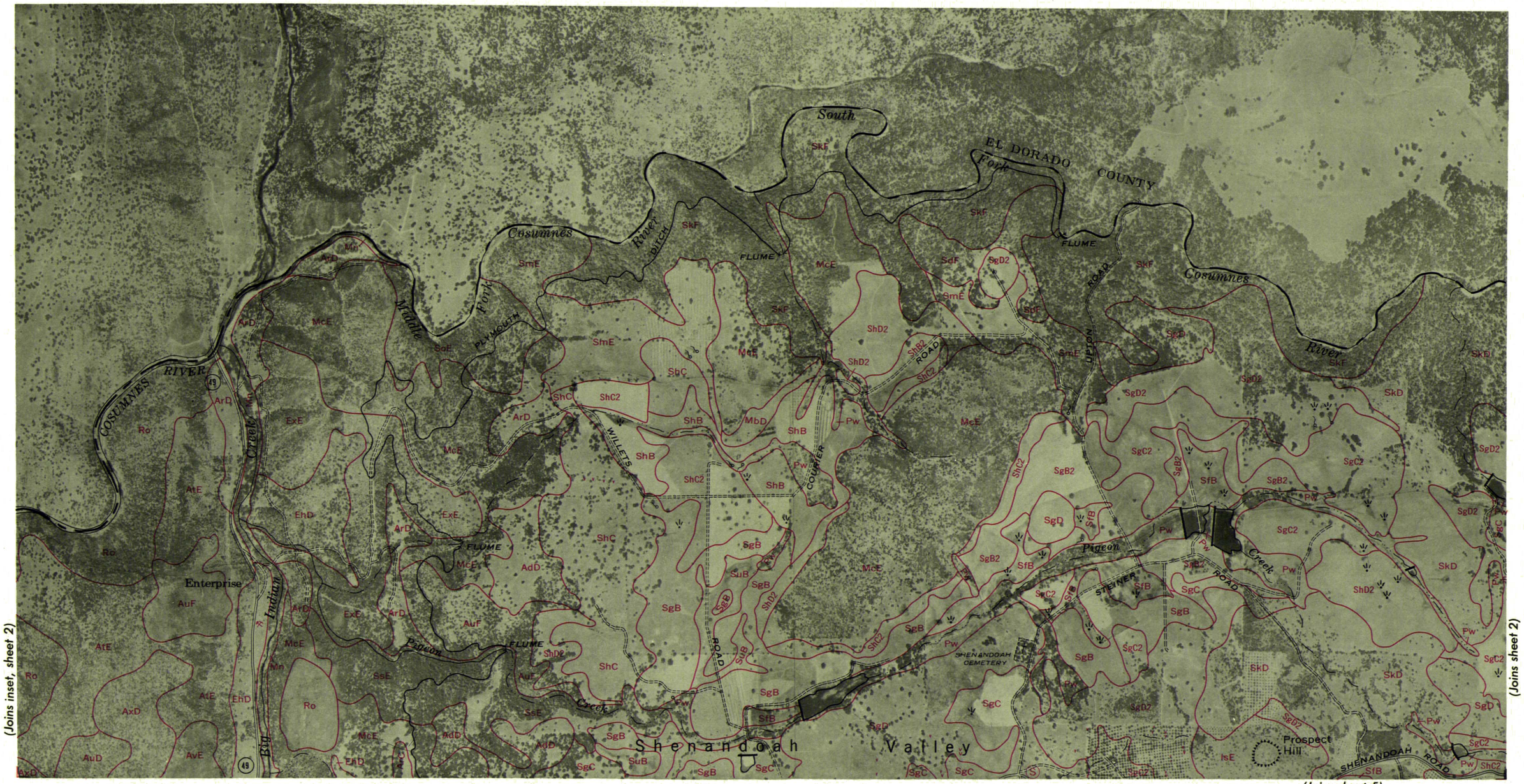
SOIL LEGEND

Each symbol consists of letters or a combination of letters and numbers. The first capital letter is the initial one of the soil name. A second capital letter, if used, shows the class of slope. Some symbols without a slope letter are for nearly level soils or land types, but others are for soils or land types that have considerable range in slope. A final number, 2 or 3, in the symbol shows that the soil is named as eroded or severely eroded.

SYMBOL	NAME
AaB	Ahwahnee loam, 3 to 9 percent slopes
AaB2	Ahwahnee loam, 3 to 9 percent slopes, eroded
AaC	Ahwahnee loam, 9 to 16 percent slopes
AaC2	Ahwahnee loam, 9 to 16 percent slopes, eroded
AaD	Ahwahnee loam, 16 to 31 percent slopes
AaD2	Ahwahnee loam, 16 to 31 percent slopes, eroded
AdD	Ahwahnee very rocky loam, 9 to 31 percent slopes
AdD3	Ahwahnee very rocky loam, 16 to 31 percent slopes, severely eroded
AdE	Ahwahnee very rocky loam, 31 to 51 percent slopes
AeE	Ahwahnee very rocky loam, shallow, 16 to 51 percent slopes
AfD	Ahwahnee extremely rocky loam, 9 to 51 percent slopes
AhB	Aiken loam, 3 to 9 percent slopes
AhC	Aiken loam, 9 to 16 percent slopes
AkC	Aiken cobbly loam, 3 to 16 percent slopes
AkD	Aiken cobbly loam, 16 to 31 percent slopes
AkE	Aiken cobbly loam, 31 to 51 percent slopes
AmE	Aiken very rocky loam, 16 to 51 percent slopes
AmF	Aiken very rocky loam, 51 to 71 percent slopes
AnD	Argonaut gravelly loam, 3 to 31 percent slopes
AoD	Argonaut very rocky loam, 3 to 31 percent slopes
ApD	Auburn silt loam, 0 to 31 percent slopes
ArC	Auburn silt loam, moderately deep, 3 to 16 percent slopes
ArD	Auburn silt loam, moderately deep, 16 to 31 percent slopes
AsB2	Auburn very rocky silt loam, 3 to 9 percent slopes, eroded
AsD	Auburn very rocky silt loam, 3 to 31 percent slopes
AsE	Auburn very rocky silt loam, 31 to 51 percent slopes
AtD	Auburn very rocky silt loam, moderately deep, 3 to 31 percent slopes
AtE	Auburn very rocky silt loam, moderately deep, 31 to 51 percent slopes
AuD	Auburn extremely rocky silt loam, 3 to 31 percent slopes
AuF	Auburn extremely rocky silt loam, 31 to 71 percent slopes
AvE	Auburn extremely rocky silt loam, moderately deep, 31 to 71 percent slopes
AwC	Auburn-Argonaut silt loams, 0 to 16 percent slopes
AxD	Auburn-Argonaut very rocky silt loams, 3 to 31 percent slopes
CaC	Cohasset loam, 5 to 16 percent slopes
CaD	Cohasset loam, 16 to 31 percent slopes
CbC	Cohasset very cobbly loam, 3 to 16 percent slopes
CbE	Cohasset very cobbly loam, 16 to 51 percent slopes
CbF	Cohasset very cobbly loam, 51 to 71 percent slopes
CcC	Cohasset very cobbly loam, moderately deep, 3 to 16 percent slopes
CcE	Cohasset very cobbly loam, moderately deep, 16 to 51 percent slopes
CoC	Cohasset very cobbly sandy loam, 3 to 16 percent slopes
CoE	Cohasset very cobbly sandy loam, 16 to 51 percent slopes
EcD	Exchequer very rocky silt loam, 3 to 31 percent slopes
EcE	Exchequer very rocky silt loam, 31 to 51 percent slopes
EhD	Exchequer and Auburn loams, 3 to 31 percent slopes
ExD	Exchequer and Auburn very rocky loams, 3 to 31 percent slopes
ExE	Exchequer and Auburn very rocky loams, 31 to 51 percent slopes
FdC	Fiddletown gravelly loam, 9 to 16 percent slopes
FdD	Fiddletown gravelly loam, 16 to 31 percent slopes
FgB	Fiddletown gravelly loam, deep, 3 to 10 percent slopes
FoE	Fiddletown very rocky loam, 16 to 51 percent slopes
FoF	Fiddletown very rocky loam, 51 to 71 percent slopes
FtE	Fiddletown very rocky loam, deep, 16 to 51 percent slopes
HaD	Henneke very rocky loam, 3 to 51 percent slopes
HcC	Holland coarse sandy loam, 5 to 9 percent slopes
HcD	Holland coarse sandy loam, 9 to 16 percent slopes
HcE	Holland coarse sandy loam, 16 to 36 percent slopes
HdC	Holland coarse sandy loam, deep, 5 to 9 percent slopes
HdD	Holland coarse sandy loam, deep, 9 to 16 percent slopes
HfD	Holland very rocky coarse sandy loam, 9 to 16 percent slopes
HfE	Holland very rocky coarse sandy loam, 16 to 51 percent slopes
HfF	Holland very rocky coarse sandy loam, 51 to 71 percent slopes
HkE	Holland very rocky coarse sandy loam, deep, 16 to 51 percent slopes
Hm	Honcut clay loam, over clay
Hn	Honcut silt loam
Ho	Honcut very fine sandy loam
Hs	Honcut very fine sandy loam, moderately well drained
Hv	Honcut very fine sandy loam, channeled
IdC	Inks loam, deep variant, 3 to 16 percent slopes
IrE	Inks loam and Rock land, 3 to 45 percent slopes
IsE	Iron Mountain very stony loam, 9 to 51 percent slopes
IvE	Iron Mountain very stony loam, rhyolite substratum, 9 to 51 percent slopes
JgE	Jiggs very rocky loam, 16 to 51 percent slopes
JmC	Josephine loam, 3 to 16 percent slopes
JmD	Josephine loam, 16 to 31 percent slopes
JmE	Josephine loam, 31 to 51 percent slopes
JnC	Josephine loam, deep, 9 to 16 percent slopes
JnD	Josephine loam, deep, 16 to 31 percent slopes
JnE	Josephine loam, deep, 31 to 51 percent slopes
JoC	Josephine very rocky loam, 3 to 16 percent slopes
JoE	Josephine very rocky loam, 16 to 51 percent slopes
JoF	Josephine very rocky loam, 51 to 71 percent slopes
JpE	Josephine very rocky loam, deep, 16 to 51 percent slopes
JpF	Josephine very rocky loam, deep, 51 to 71 percent slopes
JsE	Josephine-Maymen complex, 16 to 51 percent slopes
JxE	Josephine-Mariposa complex, 16 to 51 percent slopes
JxF	Josephine-Mariposa complex, 51 to 71 percent slopes
LaC	Laniger sandy loam, 2 to 16 percent slopes
LgB	Laniger sandy loam, thick surface, 0 to 5 percent slopes
Ln	Limestone rock land
Lo	Loamy alluvial land
Ma	Made land
MbD	Mariposa gravelly loam, 3 to 31 percent slopes
McD	Mariposa very rocky loam, 9 to 31 percent slopes
McE	Mariposa very rocky loam, 31 to 51 percent slopes
McF	Mariposa very rocky loam, 51 to 85 percent slopes
MdE	Mariposa-Maymen complex, 16 to 51 percent slopes
MdF	Mariposa-Maymen complex, 51 to 85 percent slopes
MgE	Maymen very rocky loam, 9 to 51 percent slopes
MhE	Maymen-Mariposa complex, 16 to 51 percent slopes
MkE	McCarthy very rocky loam, 16 to 51 percent slopes
MkF	McCarthy very rocky loam, 51 to 71 percent slopes
MlC	McCarthy very cobbly loam, 3 to 16 percent slopes
MmE	McCarthy and Jiggs very cobbly loams, 16 to 51 percent slopes
Mn	Mine tailings and Riverwash
Mo	Mixed alluvial land
Mp	Mixed wet alluvial land
MrB	Mokelumne sandy loam, 2 to 5 percent slopes
MsD	Mokelumne coarse sandy loam, 5 to 36 percent slopes
Mt	Mokelumne soils and Alluvial land
MuB	Musick sandy loam, 3 to 9 percent slopes
MuC	Musick sandy loam, 9 to 16 percent slopes
MuD	Musick sandy loam, 16 to 31 percent slopes
MuE	Musick sandy loam, 31 to 51 percent slopes
MvC	Musick very rocky sandy loam, 9 to 16 percent slopes
MvE	Musick very rocky sandy loam, 16 to 51 percent slopes
MvF	Musick very rocky sandy loam, 51 to 71 percent slopes
MwE	Musick very rocky sandy loam, moderately deep, 16 to 51 percent slopes
MwF	Musick very rocky sandy loam, moderately deep, 51 to 71 percent slopes
MxF	Musick extremely rocky sandy loam, moderately deep, 51 to 71 percent slopes
PaD	Pardee cobbly loam, 3 to 31 percent slopes
PnC	Pentz sandy loam, 2 to 16 percent slopes
PnC2	Pentz sandy loam, 9 to 16 percent slopes, eroded
PnD	Pentz sandy loam, 16 to 31 percent slopes
PoE	Pentz sandy loam, very shallow, 2 to 51 percent slopes
PpC	Pentz gravelly sandy loam, 2 to 16 percent slopes
PrA	Perkins loam, 0 to 3 percent slopes
PrC	Perkins loam, 3 to 16 percent slopes
PtB	Peters clay, 3 to 9 percent slopes
Pw	Placer diggings and Riverwash
RbB	Red Bluff-Mokelumne complex, 0 to 5 percent slopes
RbD	Red Bluff-Mokelumne complex, 5 to 16 percent slopes
RbE2	Red Bluff-Mokelumne complex, 16 to 36 percent slopes, eroded
RmD	Red Bluff-Mokelumne-Mine pits complex, 2 to 16 percent slopes
Ro	Rock land
RyA	Ryer silty clay loam, 0 to 3 percent slopes
Sa	Sedimentary rock land
Sb	Serpentine rock land
ScF	Shaver very rocky coarse sandy loam, 51 to 71 percent slopes
SdF	Shaver very rocky coarse sandy loam, moderately deep, 51 to 71 percent slopes
SfB	Shenandoah loam, 3 to 9 percent slopes
SgB	Sierra coarse sandy loam, 3 to 9 percent slopes
SgB2	Sierra coarse sandy loam, 3 to 9 percent slopes, eroded
SgC	Sierra coarse sandy loam, 9 to 16 percent slopes
SgC2	Sierra coarse sandy loam, 9 to 16 percent slopes, eroded
SgD	Sierra coarse sandy loam, 16 to 31 percent slopes
SgD2	Sierra coarse sandy loam, 16 to 31 percent slopes, eroded
ShB	Sierra coarse sandy loam, moderately deep, 3 to 9 percent slopes
ShB2	Sierra coarse sandy loam, moderately deep, 3 to 9 percent slopes, eroded
ShC	Sierra coarse sandy loam, moderately deep, 9 to 16 percent slopes
ShC2	Sierra coarse sandy loam, moderately deep, 9 to 16 percent slopes, eroded
ShD	Sierra coarse sandy loam, moderately deep, 16 to 31 percent slopes
ShD2	Sierra coarse sandy loam, moderately deep, 16 to 31 percent slopes, eroded
SkD	Sierra very rocky coarse sandy loam, 16 to 31 percent slopes
SkF	Sierra very rocky coarse sandy loam, 51 to 71 percent slopes
SlD3	Sierra sandy clay loam, 9 to 31 percent slopes, severely eroded
SmD	Sierra very rocky coarse sandy loam, moderately deep, 9 to 31 percent slopes
SmE	Sierra very rocky coarse sandy loam, moderately deep, 31 to 51 percent slopes
SnB	Sites loam, 3 to 9 percent slopes
SnC	Sites loam, 9 to 16 percent slopes
SnD	Sites loam, 16 to 31 percent slopes
SnE	Sites loam, 31 to 51 percent slopes
SoC	Sites loam, moderately deep, 3 to 16 percent slopes
SoD	Sites loam, moderately deep, 16 to 31 percent slopes
SoE	Sites loam, moderately deep, 31 to 51 percent slopes
SpD3	Sites clay loam, moderately deep, 3 to 31 percent slopes, severely eroded
SrC	Sites very rocky loam, 3 to 16 percent slopes
SrE	Sites very rocky loam, 16 to 51 percent slopes
SrF	Sites very rocky loam, 51 to 85 percent slopes
SsE	Sites very rocky loam, moderately deep, 16 to 51 percent slopes
StE	Sites-Mariposa complex, 16 to 51 percent slopes
SuB	Snelling loam, moderately well drained, 0 to 9 percent slopes
SvA	Snelling fine sandy loam, 0 to 2 percent slopes
SvB	Snelling fine sandy loam, 2 to 5 percent slopes
SvC	Snelling fine sandy loam, 5 to 9 percent slopes
SwD	Snelling sandy loam, 9 to 16 percent slopes
SwE	Snelling sandy loam, 16 to 31 percent slopes
SxD	Supan cobbly loam, 3 to 31 percent slopes
SyD	Supan very cobbly loam, moderately deep, 3 to 31 percent slopes
SyE	Supan very cobbly loam, moderately deep, 31 to 51 percent slopes
TcE	Tiger Creek very rocky loam, 16 to 51 percent slopes
WcD	Windy cobbly sandy loam, 9 to 16 percent slopes
WcE	Windy cobbly sandy loam, 16 to 51 percent slopes

Soil map constructed 1963 by Cartographic Division, Soil Conservation Service, USDA, from 1960 aerial photographs. Controlled mosaic based on California plane coordinate system, second zone, Lambert conformal conic projection. 1927 North American datum.

N



(Joins inset, sheet 2)

(Joins sheet 2)

(Joins sheet 5)

0 ½ 1 Mile

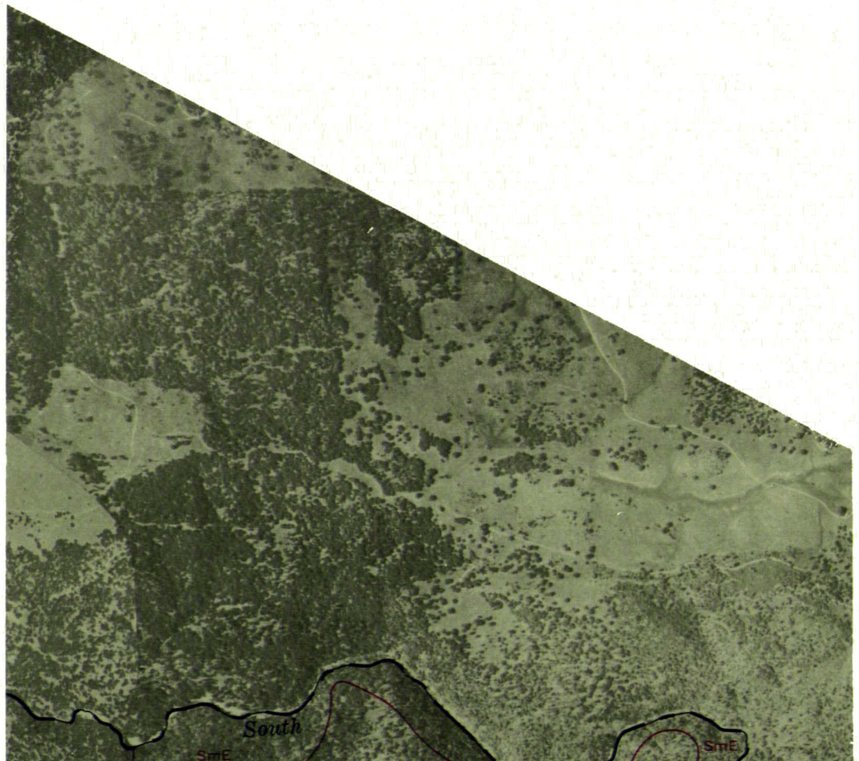
Scale 1:20 000

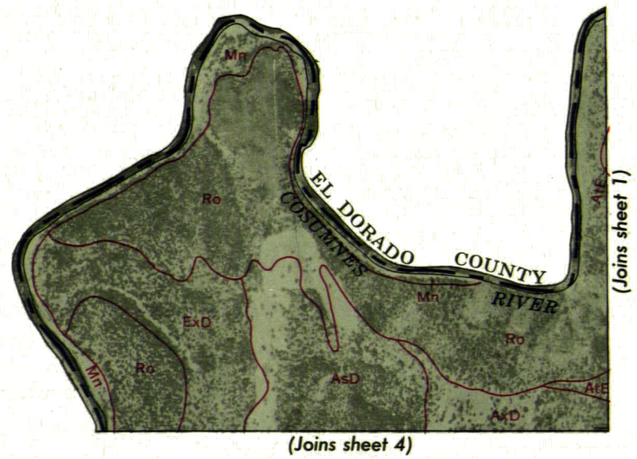
0 5000 Feet

This map is one of a set compiled in 1964 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture, and the California Agricultural Experiment Station.

(2)

N





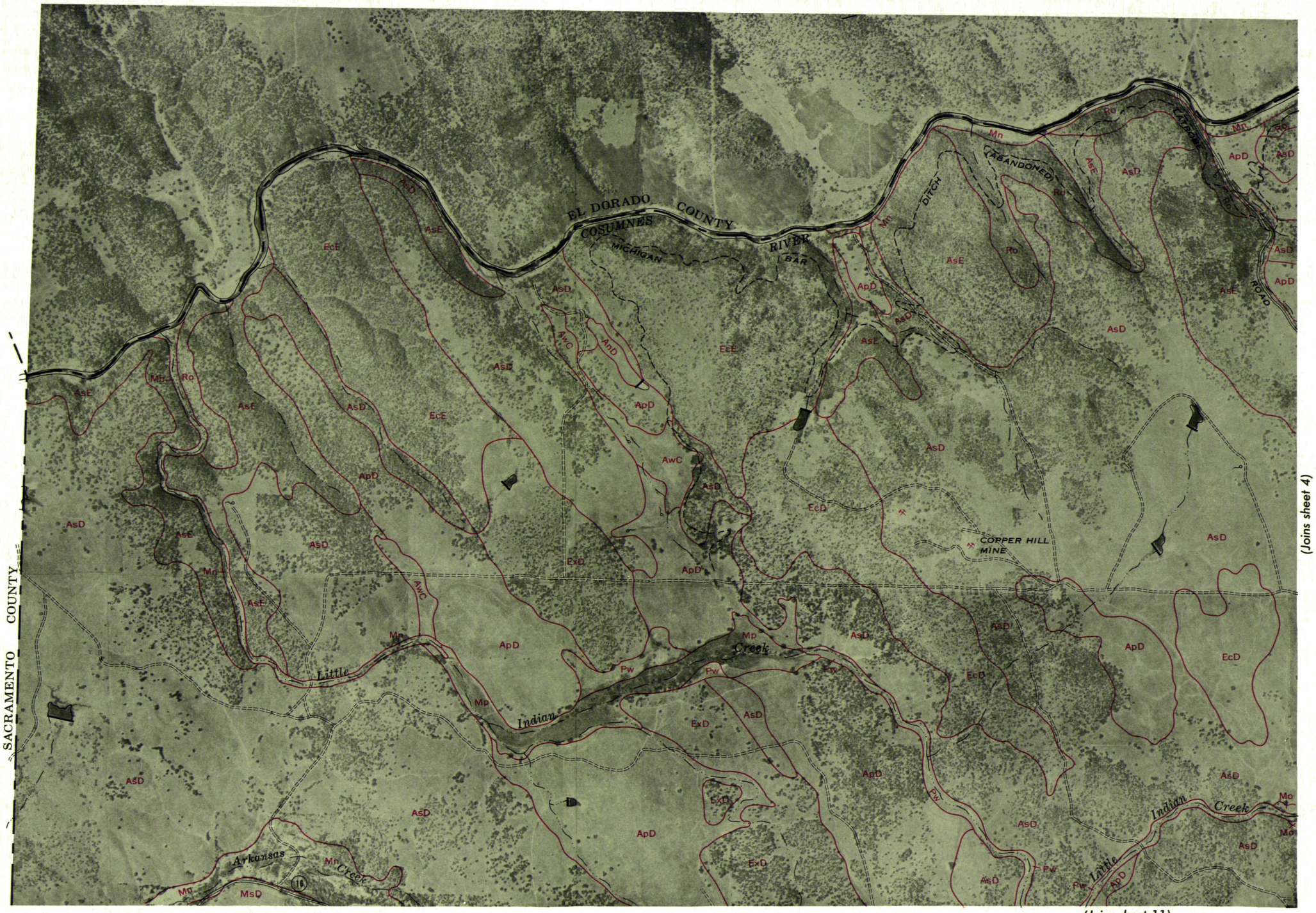
(Joins sheet 1)

0 ½ 1 Mile

Scale 1:20.000

0 5000 Feet

This map is one of a set compiled in 1964 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture, and the California Agricultural Experiment Station.



AMADOR AREA, CALIFORNIA — SHEET NUMBER 4

4

N

(Joins inset, sheet 2)

(Joins sheet 3)

(Joins sheet 5)

(Joins sheet 12)

COSUMNES RIVER

EL DORADO COUNTY

(ABANDONED) DITCH

MICHIGAN BAR

LATROBE ROAD

TAYLOR ROAD

PLYMOUTH SACRAMENTO RD

Grapevine Ravine

Bisbee Peaks

Little Indian Pw Creek

Spring Valley Branch

Mn Ro AsD EcD ApD ArC EcE ExE ExD EhD AuD AxD AwC HaD Hm Sb Mo AsE

0 ½ 1 Mile

Scale 1:20 000

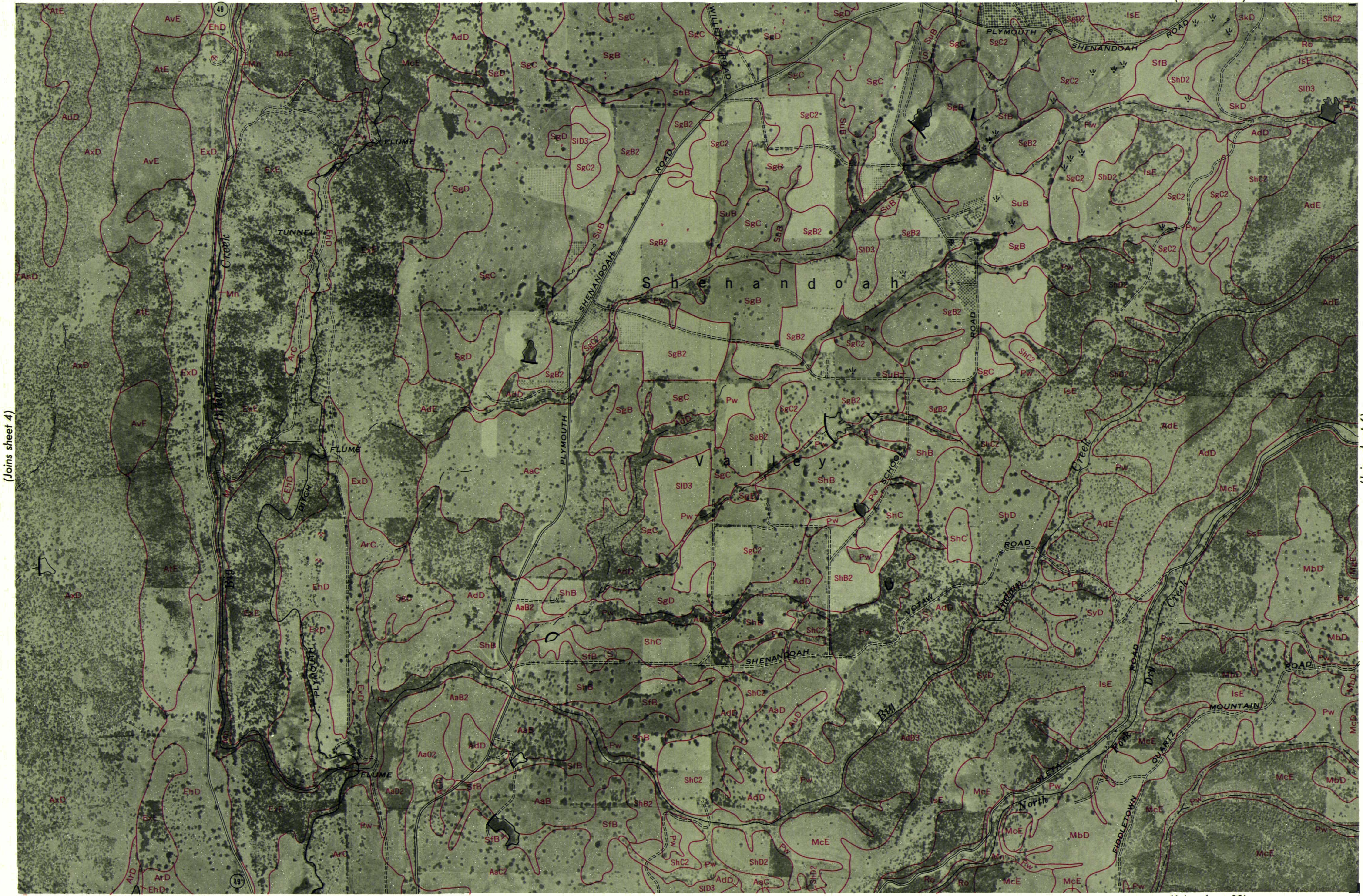
0 5000 Feet

AMADOR AREA, CALIFORNIA — SHEET NUMBER 5

5

(Joins sheet 1)

N



(Joins sheet 4)

(Joins sheet 6)

This map is one of a set compiled in 1964 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture, and the California Agricultural Experiment Station.

0 ½ 1 Mile

Scale 1:20 000

0 5000 Feet

(Joins sheet 13)

6

(Joins sheet 2)

N

(Joins sheet 5)

(Joins sheet 7)

(Joins sheet 14)

Fiddletown

FIDDLETOWN ROAD

SHENANDOAH ROAD

OLETA ROAD

QUARTZ MT. RD. ROAD

TYLER ROAD

SILVER LAKE ROAD

HALE ROAD

DAWRENCE ROAD

COOPER MINE

GOLDEN TREASURE MINE

Big Indian Creek

North Fork Dry Creek

S. Fk. Cosumnes River

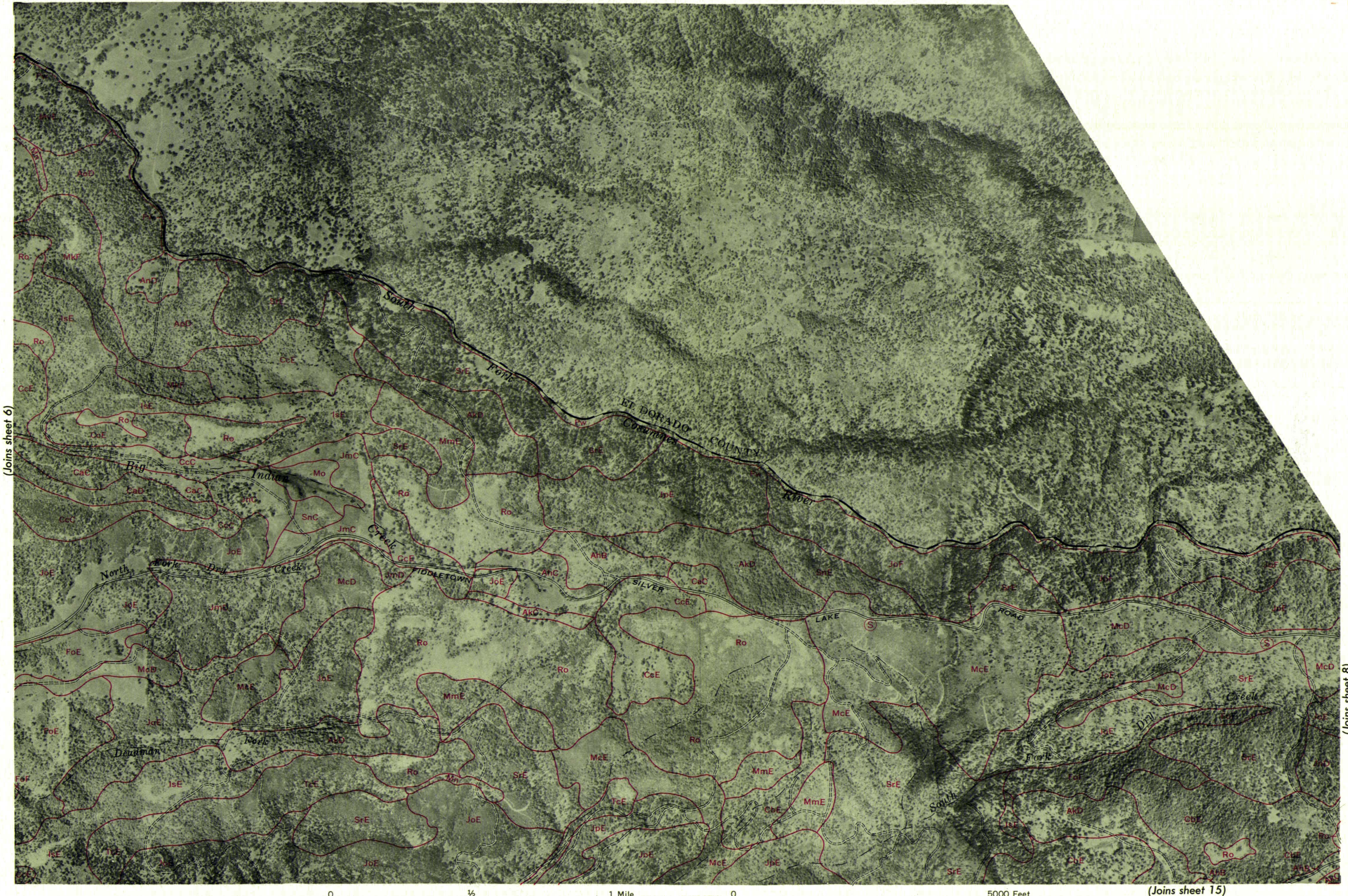
EL DORADO CO

Pendleton Fork

0 ½ 1 Mile

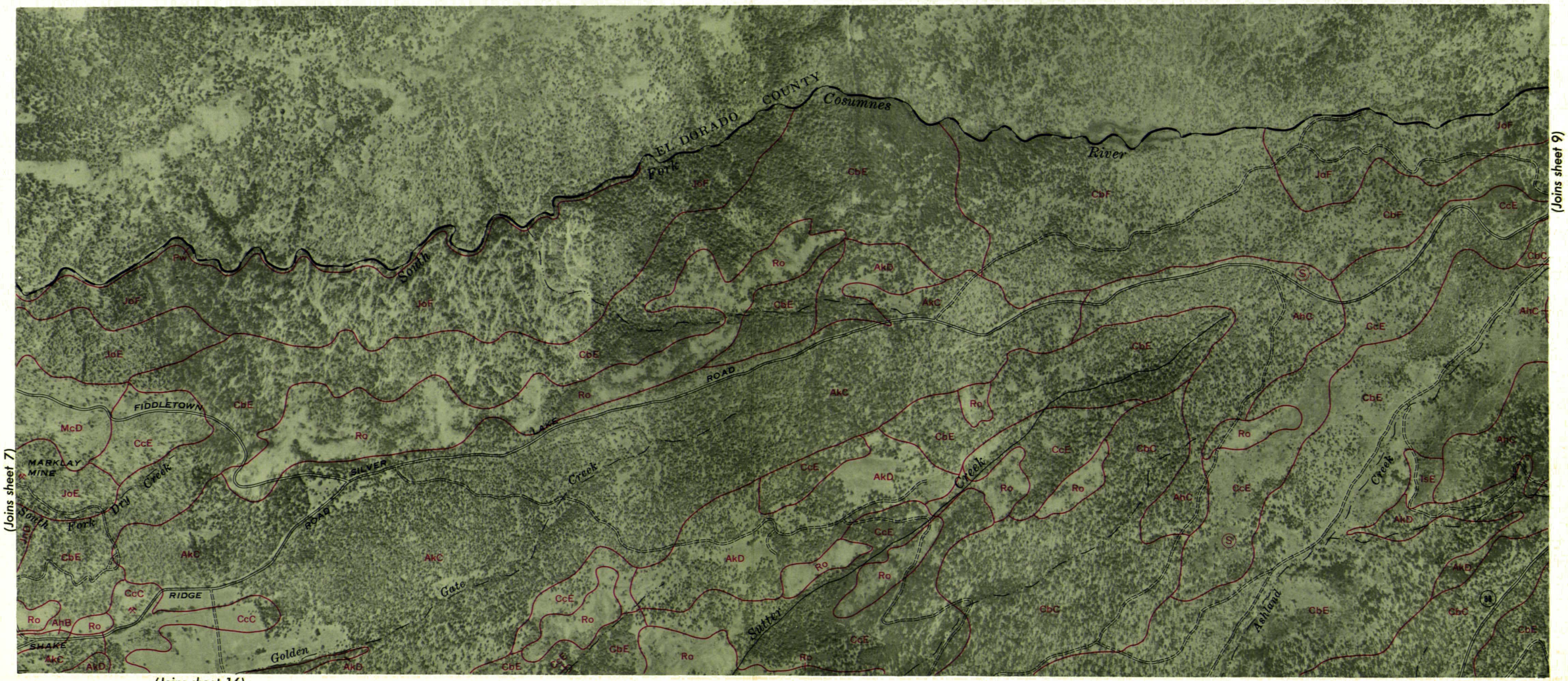
Scale 1:20.000

0 5000 Feet



(8)

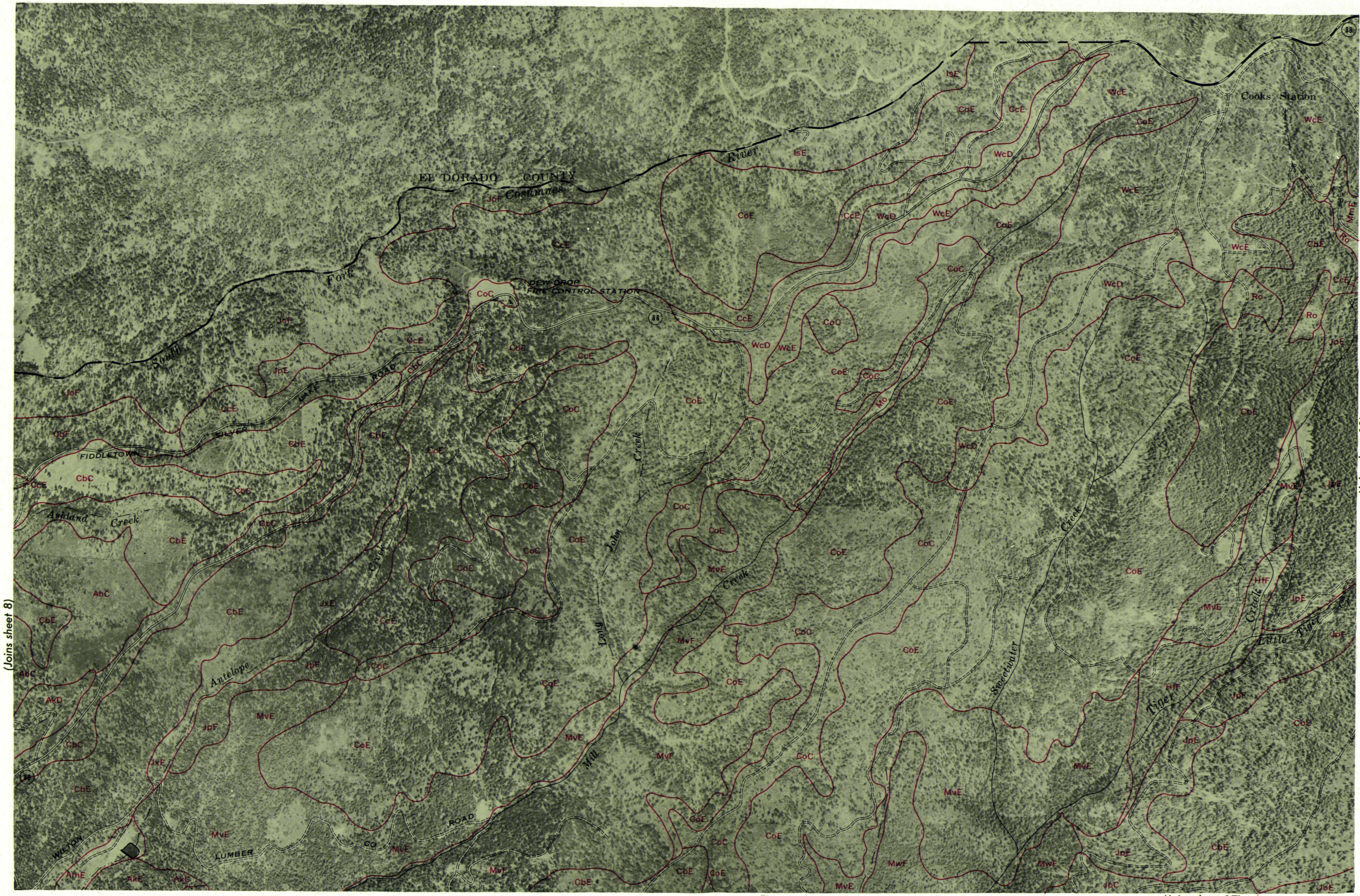
N



0 ½ 1 Mile Scale 1:20 000 0 5000 Feet

9

N



(Joins sheet 8)

(Joins sheet 10)

(Joins sheet 17)

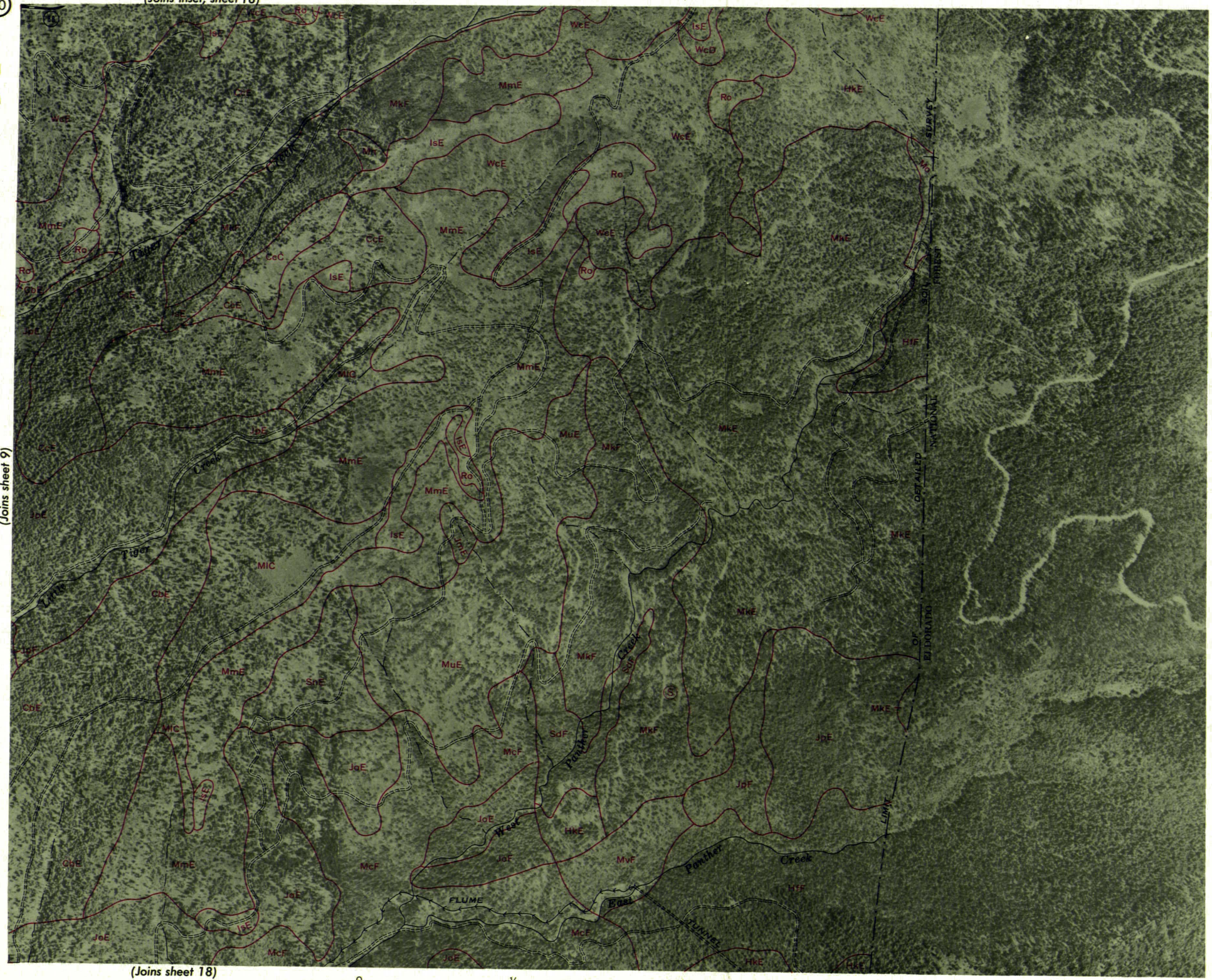
0 ½ 1 Mile Scale 1:20 000 0 5000 Feet

This map is one of a set compiled in 1964 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture, and the California Agricultural Experiment Station.

(10)

(Joins inset, sheet 18)

N



(Joins sheet 9)

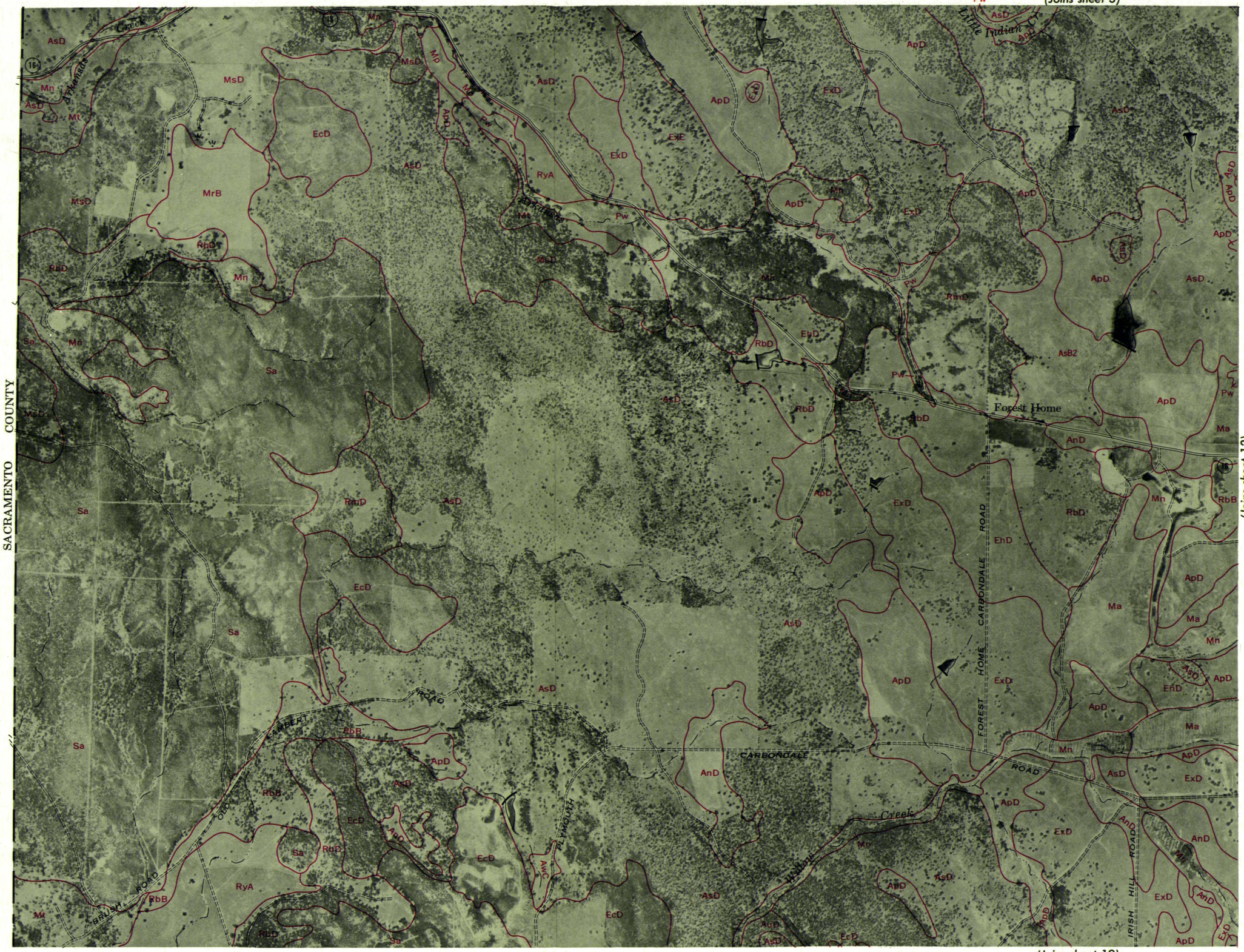
(Joins sheet 18)

0 ½ 1 Mile

Scale 1:20 000

0 5000 Feet

SACRAMENTO COUNTY



AMADOR AREA, CALIFORNIA — SHEET NUMBER 12

(12)

N

(Joins sheet 4)

(Joins sheet 11)

(Joins sheet 13)

(Joins sheet 20)

Four Corners

Sugarloaf

RED HILL MINE

Indian Creek

Little Indian Creek

Willow Creek

SACRAMENTO ROAD

PLYMOUTH ROAD

OLD PLYMOUTH ROAD

LATROBE ROAD

CARBONDALE ROAD

BARNES ROAD

0 ½ 1 Mile

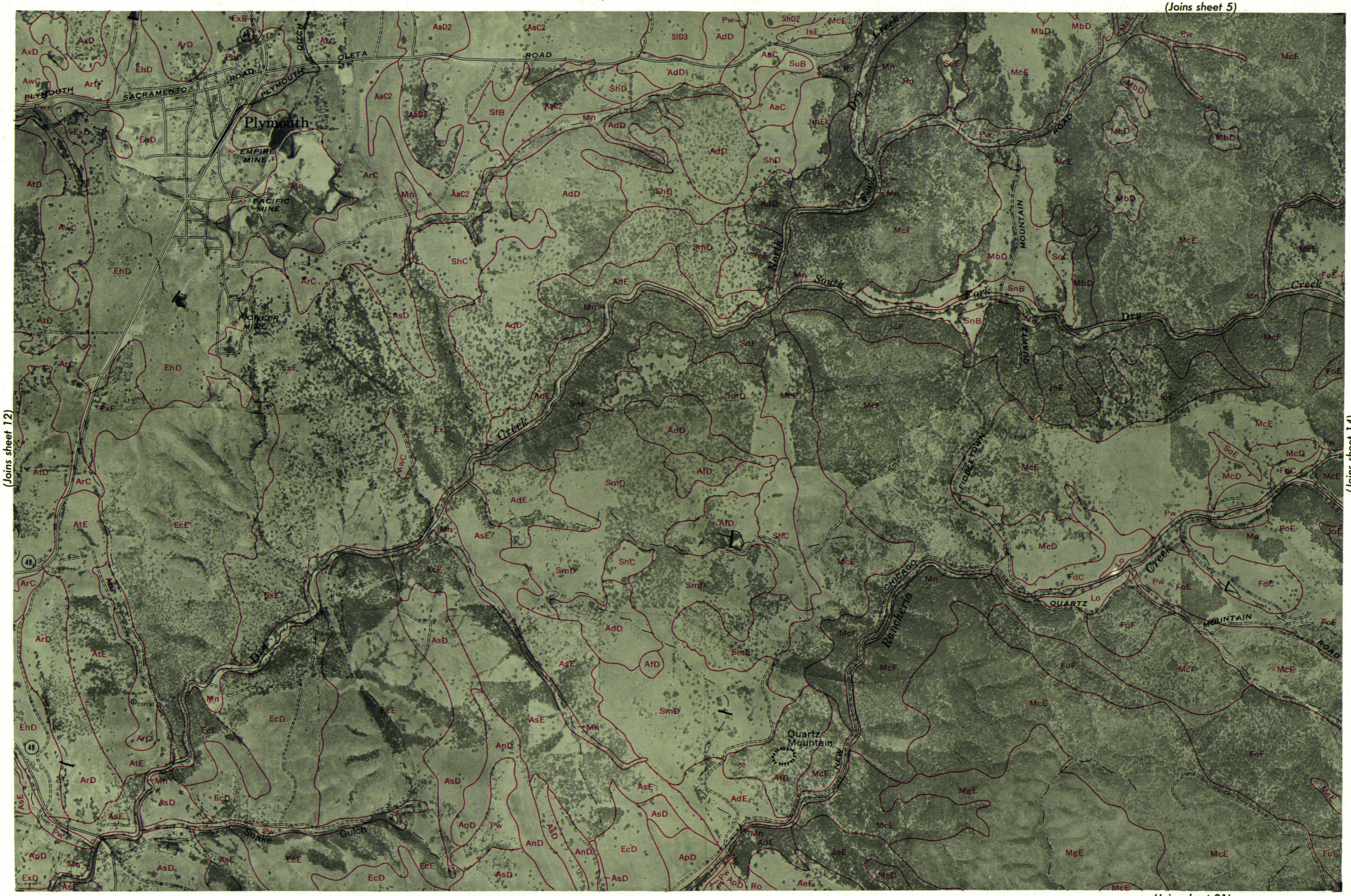
Scale 1:20,000

0 5000 Feet

(Joins sheet 5)

13

N



(Joins sheet 12)

(Joins sheet 14)

(Joins sheet 21)

0 ½ 1 Mile

Scale 1:20 000

0 5000 Feet

AMADOR AREA, CALIFORNIA — SHEET NUMBER 14

14

N

(Joins sheet 6)

(Joins sheet 13)

(Joins sheet 15)

(Joins sheet 22)

AMERICAN FLAT ROAD

Deadman Creek

South Fork Dry Creek

Rancheria Creek

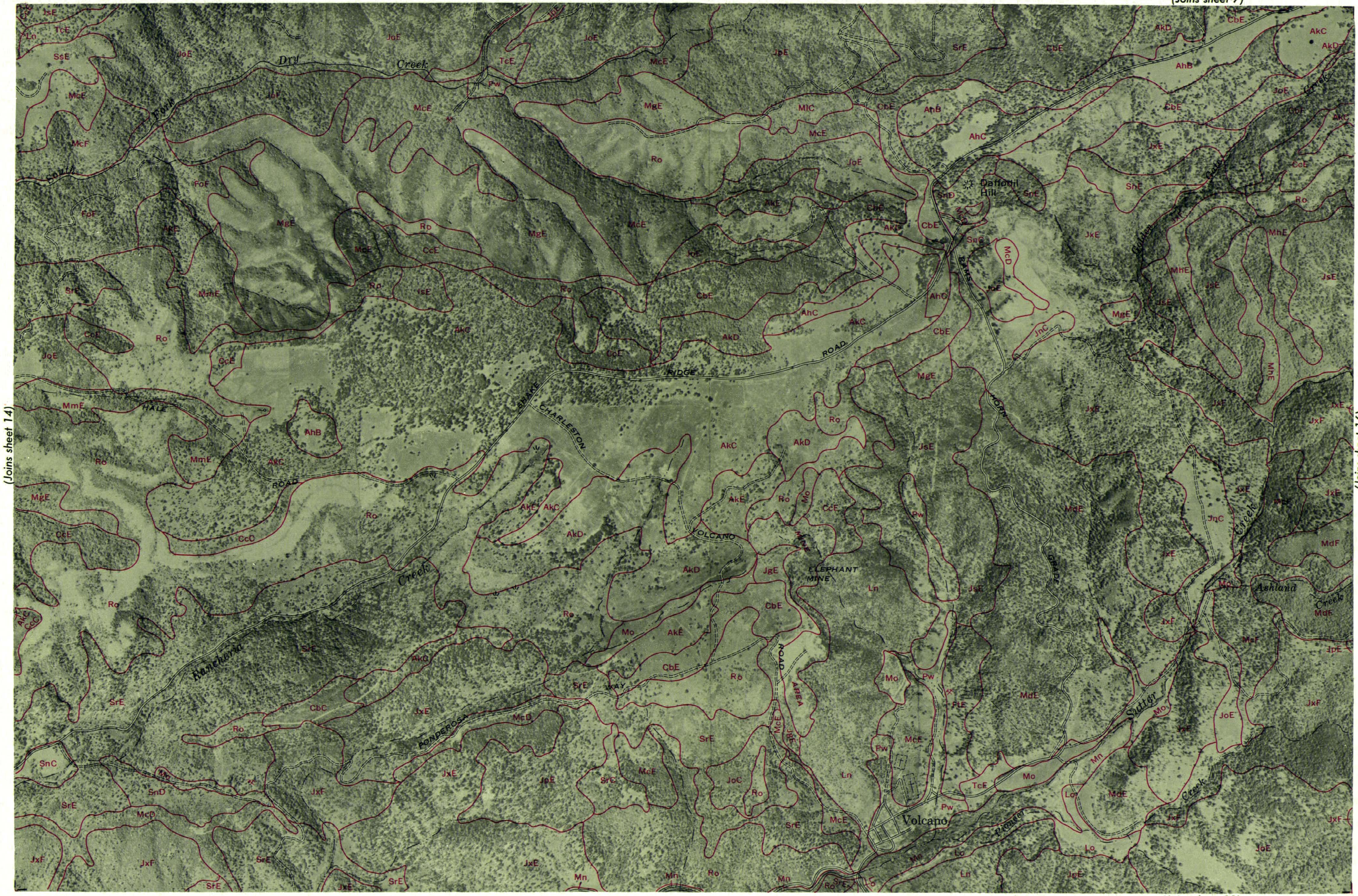
SHAKE RIDGE ROAD

Amador Creek

0 ½ 1 Mile Scale 1:20 000 0 5000 Feet

(Joins sheet 7)

15



(Joins sheet 14)

(Joins sheet 16)

This map is one of a set compiled in 1964 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture, and the California Agricultural Experiment Station.

0 ½ 1 Mile Scale 1:20 000 0 5000 Feet

(Joins sheet 23)

(16)

N

(Joins sheet 8)

(Joins sheet 15)

(Joins sheet 17)

(Joins sheet 24)

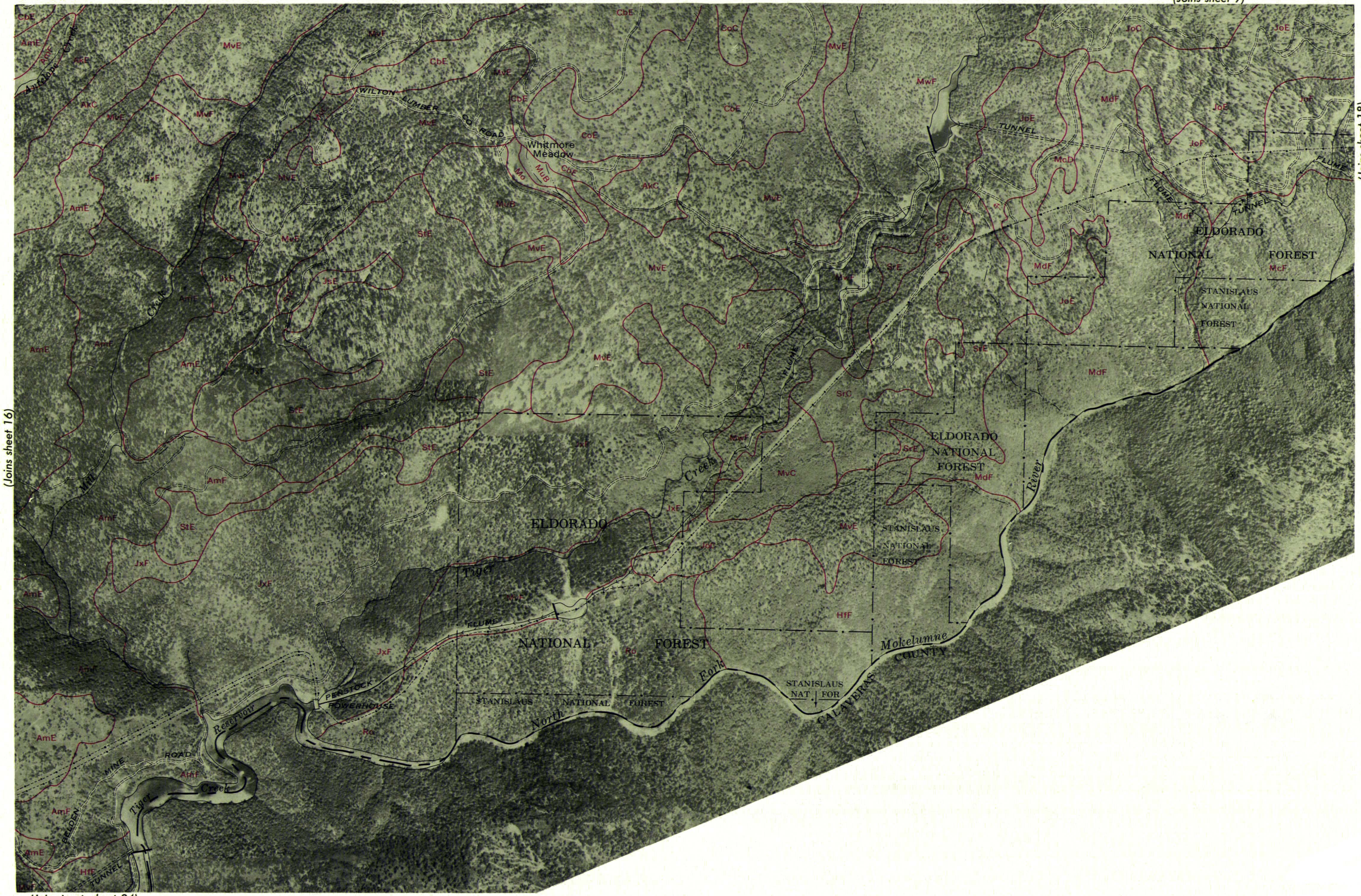
Golden Gate Creek
Sutter Creek
Ashland Creek
Misery Creek
Pioneer Creek
Inspiration Point
Mount Crossman
Antelope Creek
Barton
INSPIRATION LODGE
PIONEER CREEK ROAD
BUCKHORN ROAD
BELDEN MINE ROAD
BLACK PRINCE ROAD

0 ½ 1 Mile
Scale 1:20 000
0 5000 Feet

(Joins sheet 9)

(Joins sheet 16)

(Joins sheet 18)



(Joins inset, sheet 24)

0 ½ 1 Mile Scale 1:20 000 0 5000 Feet

This map is one of a set compiled in 1964 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture, and the California Agricultural Experiment Station.

AMADOR AREA, CALIFORNIA — SHEET NUMBER 18

(Joins sheet 11)

N

0 ½ 1 Mile Scale 1:20 000 0 5000 Feet

(Joins sheet 20)

(Joins sheet 25)

(Joins sheet 12)

(Joins sheet 19)

(Joins sheet 21)

(Joins sheet 26)

N

Rocky Point

Dry Creek

Amador Creek

New York Gulch

Horse Creek

Mule Creek

BARNEY ROAD

PAINE ROAD

DAM

0 ½ 1 Mile

Scale 1:20 000

0 5000 Feet

(Joins sheet 13)

21

N

(Joins sheet 20)

(Joins sheet 22)

(Joins sheet 27)

0 ½ 1 Mile Scale 1:20 000 0 5000 Feet

22

(Joins sheet 14)

N

(Joins sheet 21)

(Joins sheet 23)

(Joins sheet 28)

Creek
Amador ROAD
RIDGE
SHAKE GULCH ROAD
PINE
CREEK
SUTTER
Mn
KOLCANO
Sutter
ROAD
Creek
Gulch
Ranch
New York
ROAD
CLIMAX
ROAD
RIDGE
Hamricks Grade
CANAL
AMADOR
TUNNEL
NEW YORK RANCH RD
AMADOR
CANAL
FLUME

0 ½ 1 Mile

Scale 1:20 000

0 5000 Feet

AMADOR AREA, CALIFORNIA — SHEET NUMBER 23

(Joins sheet 15)

(Joins sheet 22)

(Joins sheet 24)

(Joins sheet 29)

Pine Grove

0 ½ 1 Mile

Scale 1:20,000

0 5000 Feet

(24)

(Joins sheet 16)

(Joins sheet 23)

(Joins inset below)

N

Pioneer Creek

South Sutter Branch

PIONEER CREEK ROAD

WEST POINT BLACK PRINCE TUNNEL ROAD

PENSTOCK

WEST POINT POWERHOUSE

RED CORRAL ROAD

ELECTRA TUNNEL

STANDARD CANAL

STANDARD CANAL

UPPER

LOWER

North Fork Mokelumne River

CALAVERAS COUNTY

(Joins sheet 17)

(Joins upper right)

TUNNEL

N. Fork Mokelumne R.

CALAVERAS COUNTY

0 ½ 1 Mile

Scale 1:20 000

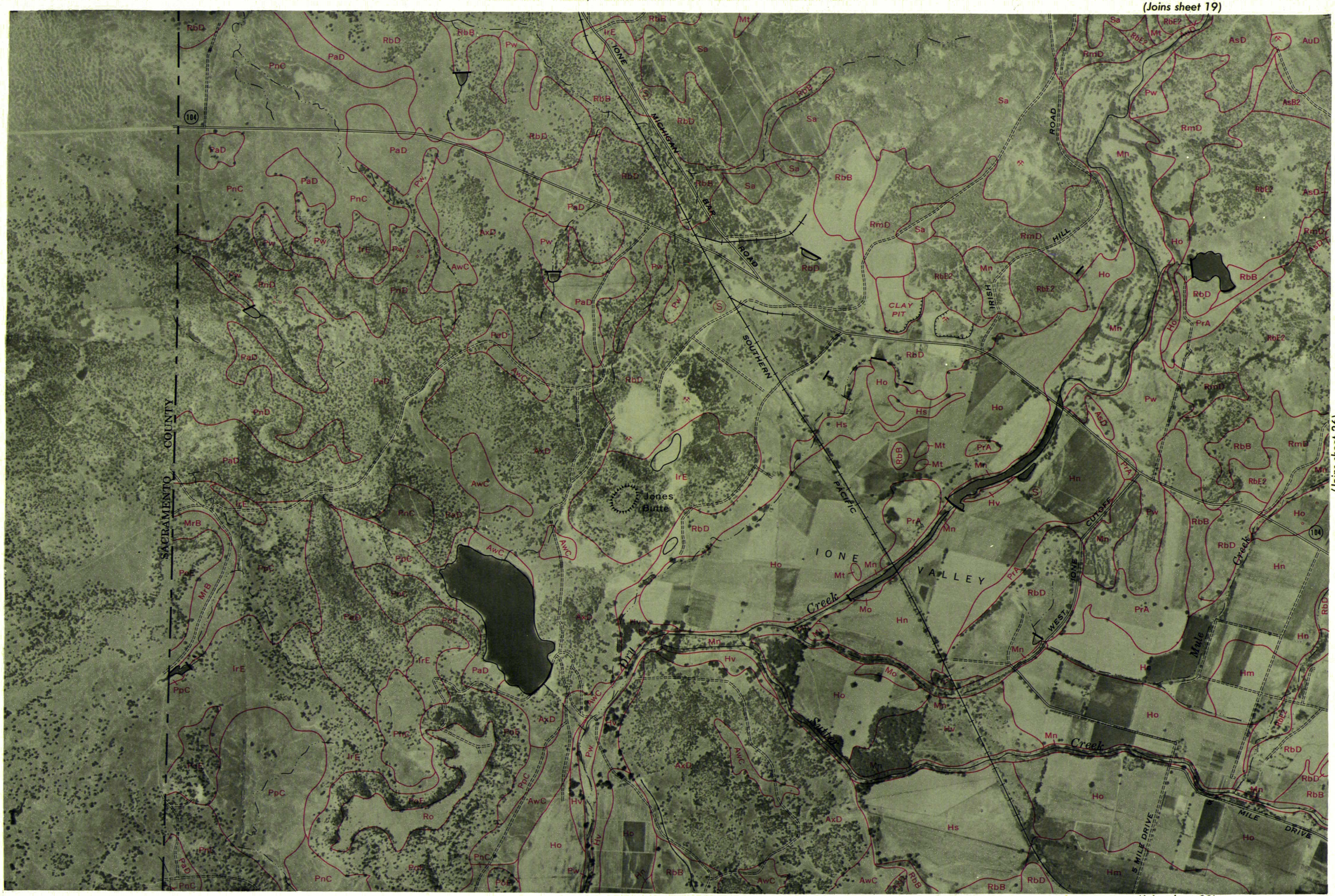
0 5000 Feet

AMADOR AREA, CALIFORNIA — SHEET NUMBER 25

(Joins sheet 19)

25

N



(Joins sheet 26)

(Joins sheet 30)

0 ½ 1 Mile Scale 1:20.000 0 5000 Feet

26

(Joins sheet 20)

N

(Joins sheet 25)

(Joins sheet 27)

(Joins sheet 31)

Scale 1:20 000

0 ½ 1 Mile

0 5000 Feet

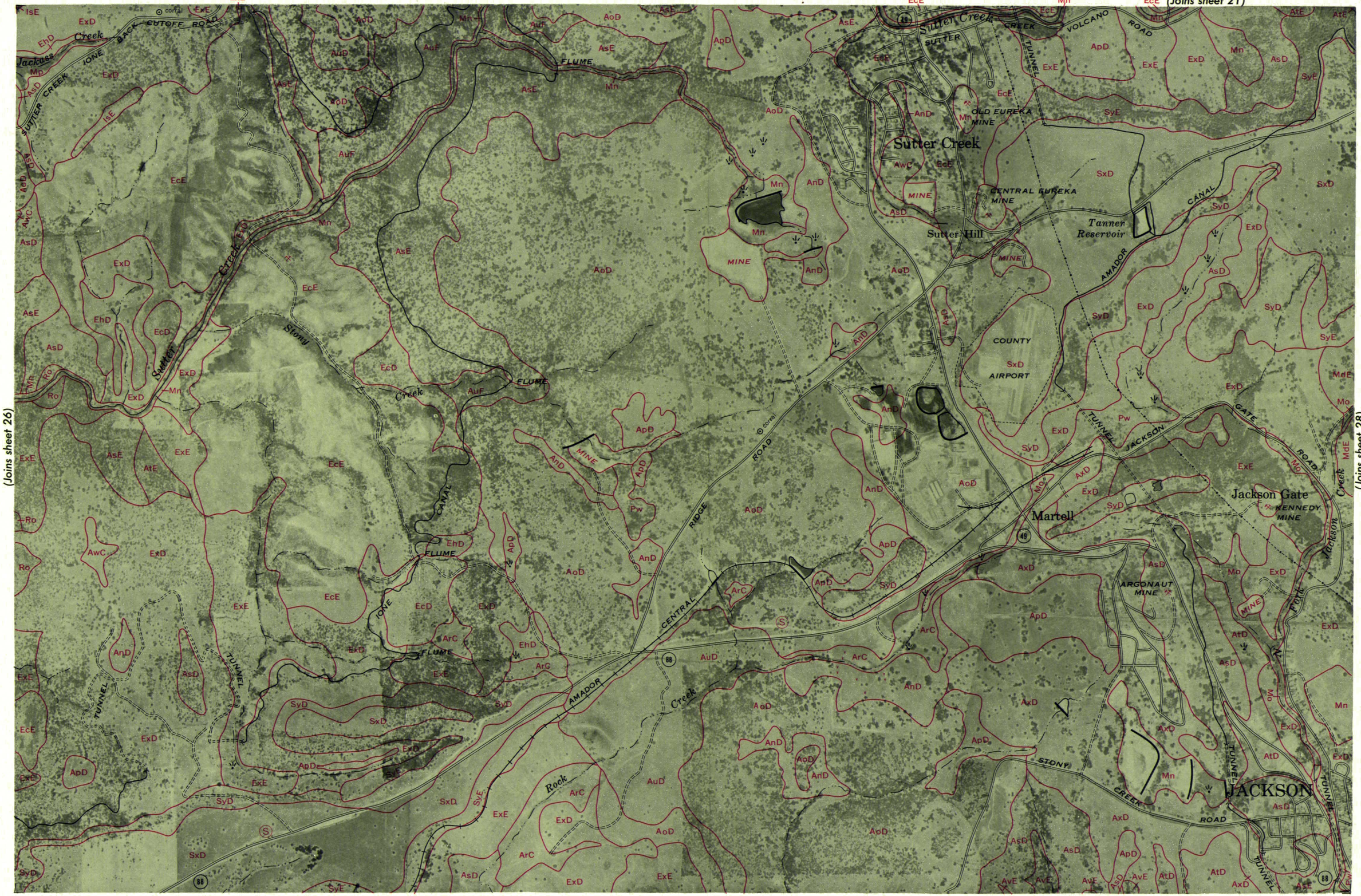
AMADOR AREA, CALIFORNIA — SHEET NUMBER 27

(Joins sheet 21)

(Joins sheet 26)

(Joins sheet 28)

(Joins sheet 32)



0 ½ 1 Mile Scale 1:20.000 0 5000 Feet

28

(Joins sheet 22)

N

JACKSON INDIAN RANCHERIA

JACKSON

(Joins sheet 27)

(Joins sheet 29)

(Joins sheet 33)

0 ½ 1 Mile Scale 1:20 000 0 5000 Feet

AMADOR AREA, CALIFORNIA — SHEET NUMBER 29

29

N

(Joins sheet 23)

(Joins sheet 28)

(Joins sheet 34)

MT ZION STATE FOREST

Mt Zion

MT ZION STATE FOREST

Clinton Peak

Lake Tabeaud

FLUME

CANAL

ROAD

Creek

Fork

RIVER

CALAVERAS COUNTY

MOKELUMNE

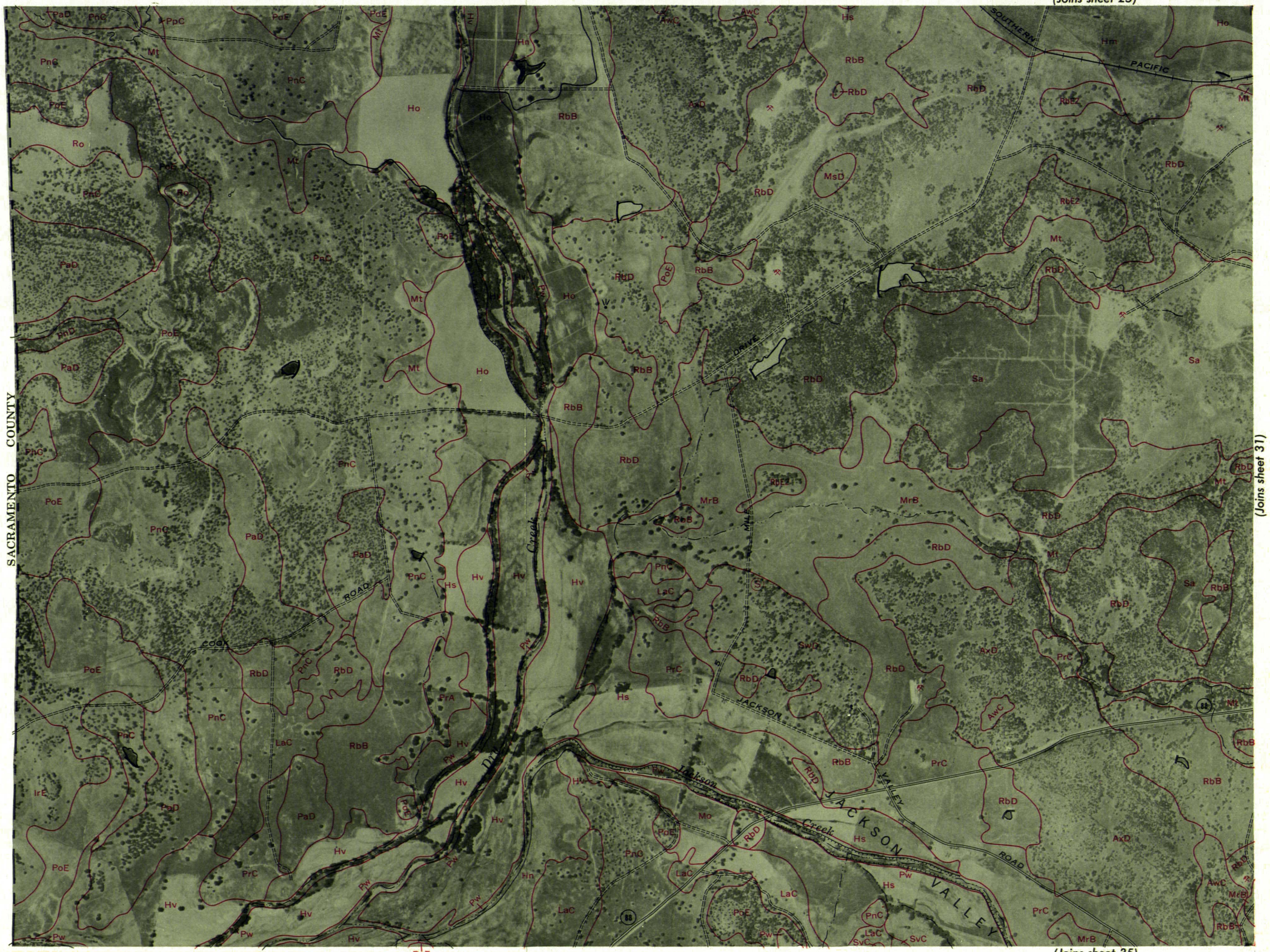
0 ½ 1 Mile Scale 1:20 000 0 5000 Feet

This map is one of a set compiled in 1964 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture, and the California Agricultural Experiment Station.

(30)

N

(Joins sheet 25)



(Joins sheet 31)

0 ½ 1 Mile

Scale 1:20 000

0 5000 Feet

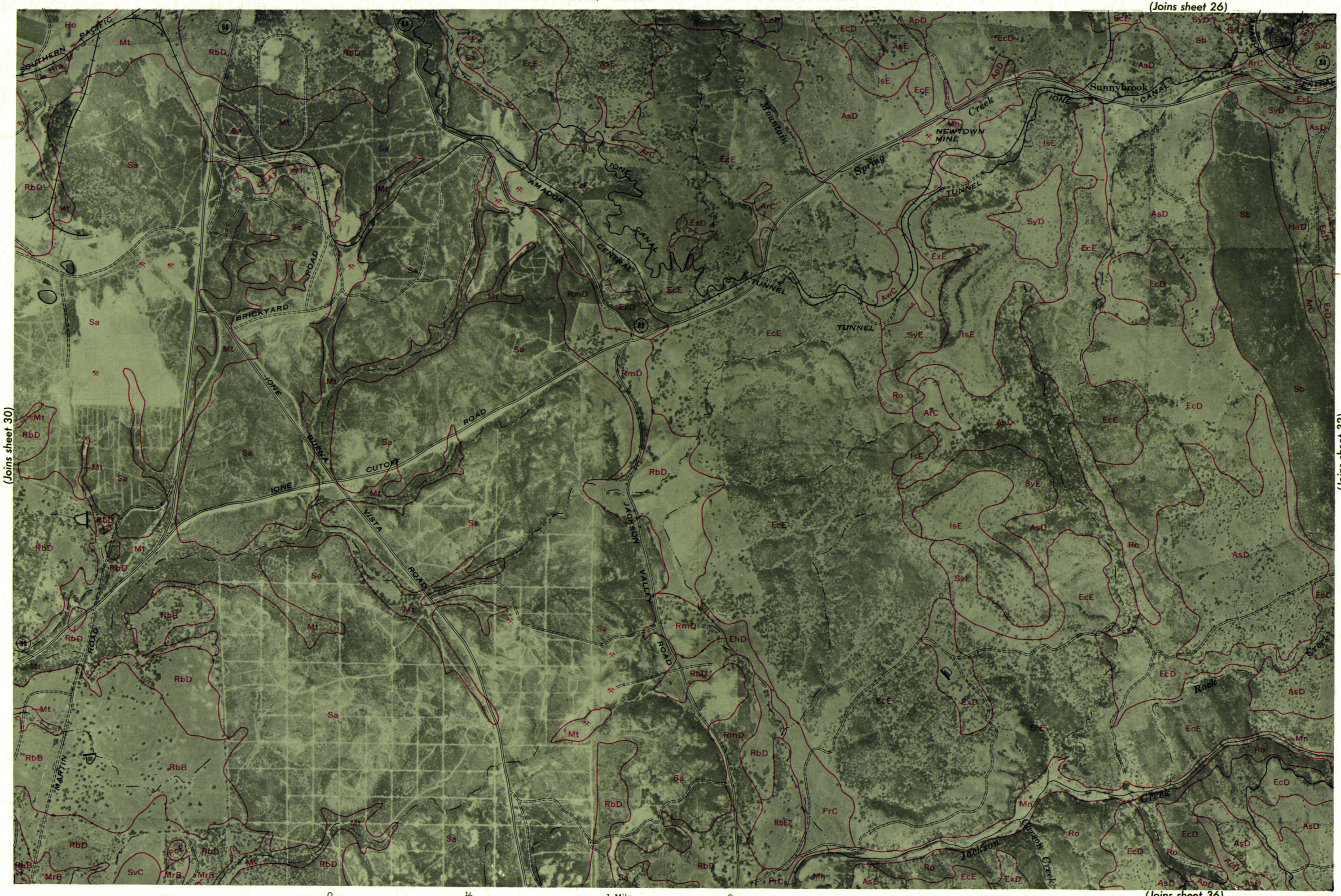
(Joins sheet 35)

AMADOR AREA, CALIFORNIA — SHEET NUMBER 31

(Joins sheet 26)

31

N



0 ½ 1 Mile Scale 1:20,000 0 5000 Feet

This map is one of a set compiled in 1964 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture, and the California Agricultural Experiment Station.

32

N

(Joins sheet 27)

(Joins sheet 31)

(Joins sheet 33)

(Joins sheet 37)

AMADOR

CENTRAL

AMADOR TUNNEL

AMADOR CANAL

STONY CREEK

Rock Creek

Jackson Creek

Jackass Gulch

Grapevine Gulch

Santa Maria Gulch

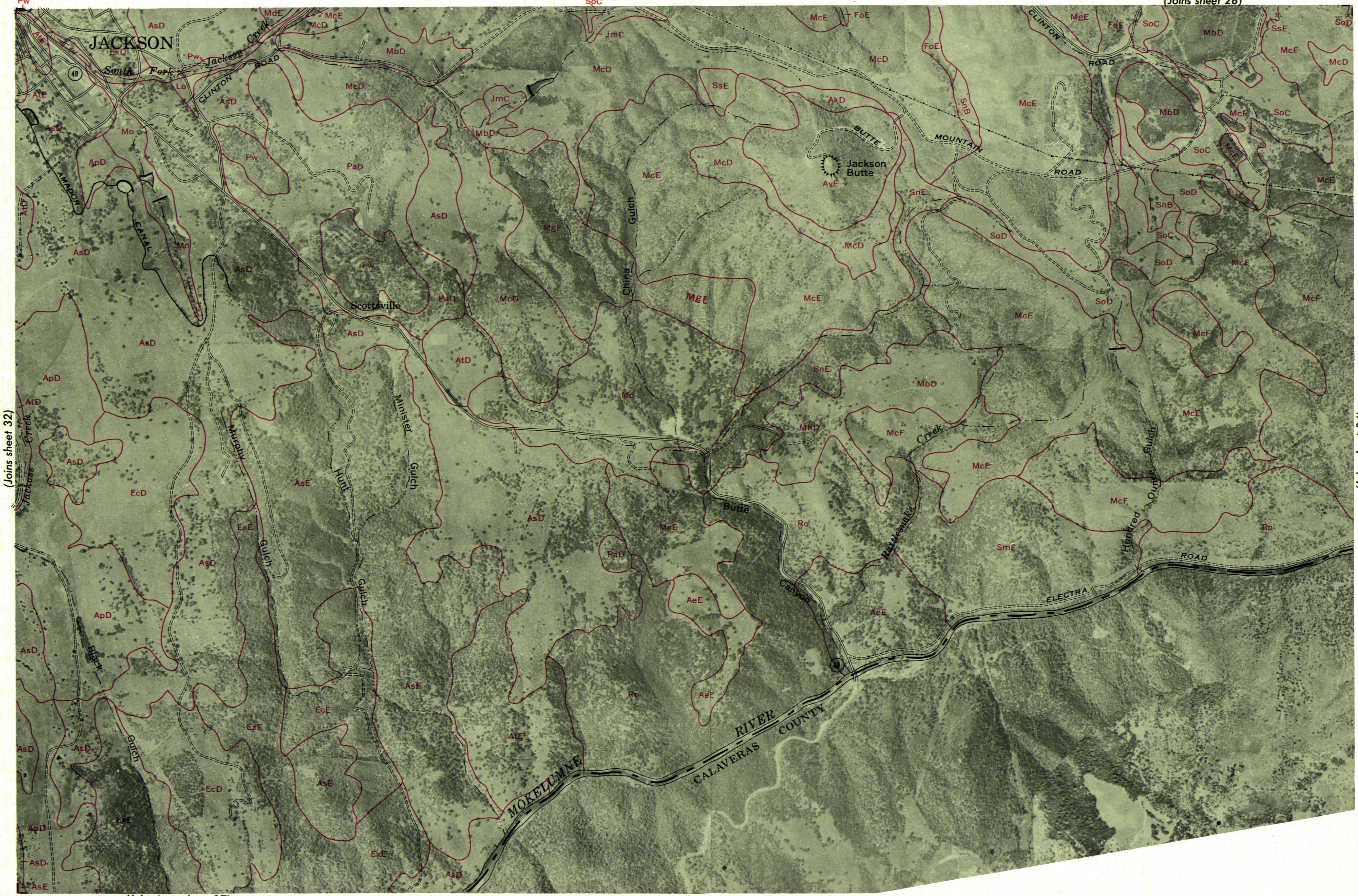
FLUME

0 ½ 1 Mile

Scale 1:20 000

0 5000 Feet

(Joins sheet 28)



(Joins sheet 32)

(Joins sheet 34)

(Joins inset, sheet 37)

Scale 1:20 000

0 ½ 1 Mile

0 5000 Feet

This map is one of a set compiled in 1964 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture, and the California Agricultural Experiment Station.

AMADOR AREA, CALIFORNIA — SHEET NUMBER 34

(34)

(Joins sheet 29)

N

SoD SoE McD McE Pw McF Ro

Lake Tabeaud

TUNNEL

FLUME

UPPER STANDARD

LOWER STANDARD

CANAL

PONDEROSA WAY

ELECTRA

PENSTOCK

Electra

POWERHOUSES

ROAD

MOKELUMNE RIVER

CALAVERAS COUNTY

(Joins sheet 33)

0 ½ 1 Mile

Scale 1:20 000

0 5000 Feet

(Joins sheet 30)

N

SACRAMENTO CO

SAN JOAQUIN COUNTY

Dry Creek

JACKSON VALLEY

Jackson Creek

JACKSON VALLEY TO CLEMENTS ROAD

Rabbit Creek

Murphy Creek

Grapevine Gulch

88

S

Hv Pw Hn LaC PoE Hs SvC PnD SwD PnC PrA IrE PaD LgB PtB AxD RbB MrB Ho Hσ

(Joins sheet 36)

(Joins sheet 38)

0 ½ 1 Mile Scale 1:20 000 0 5000 Feet

This map is one of a set compiled in 1964 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture, and the California Agricultural Experiment Station.

(36)

(Joins sheet 31)

N

JACKSON VALLEY ROAD

Buena Vista

JACKSON VALLEY

Jackson Creek

LANCHA PLANA ROAD

BUENA VISTA ROAD

Pardee Reservoir

Carbon Creek

Stony Creek

CAMANCHE VALLEY ROAD

BUENA VISTA INDIAN RESERVATION ROAD

Buena Vista Peaks

Grapevine Gulch

China Gulch

(Joins sheet 35)

(Joins sheet 37)

(Joins sheet 39)

0 ½ 1 Mile Scale 1:20.000 0 5000 Feet

AMADOR AREA, CALIFORNIA — SHEET NUMBER 37

(Joins sheet 32)

37

N

(Joins inset below)

(Joins sheet 36)

(Joins sheet 33)

(Joins upper right)

(Joins inset, sheet 39)

STONY CREEK ROAD

MOKELUMNE RIVER

CALAVERAS COUNTY

PARDEE RESERVOIR

Black Gulch

Schoolland Gulch

0 ½ 1 Mile

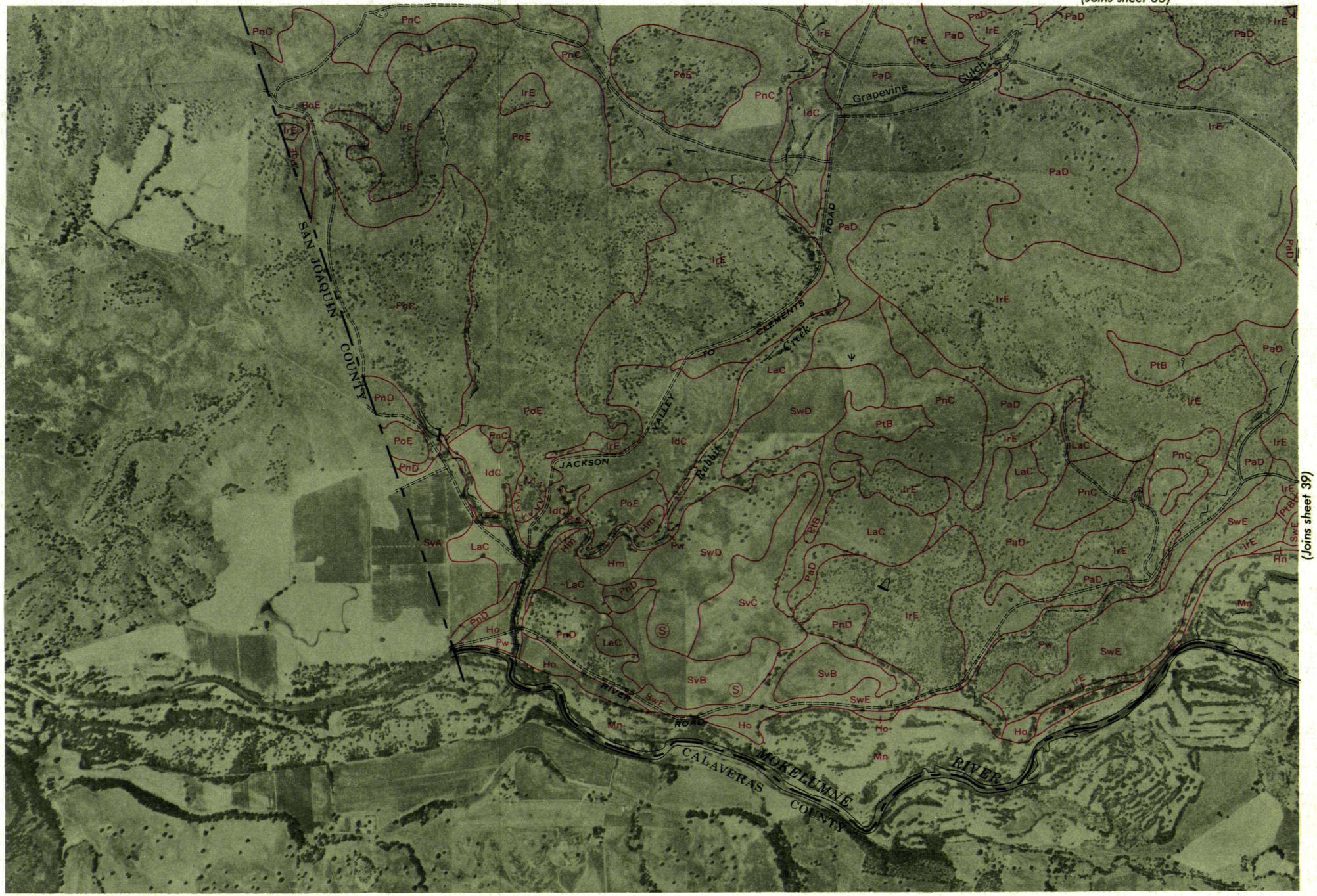
Scale 1:20 000

0 5000 Feet

N

(Joins sheet 35)

(Joins sheet 39)



0 ½ 1 Mile Scale 1:20,000 0 5000 Feet

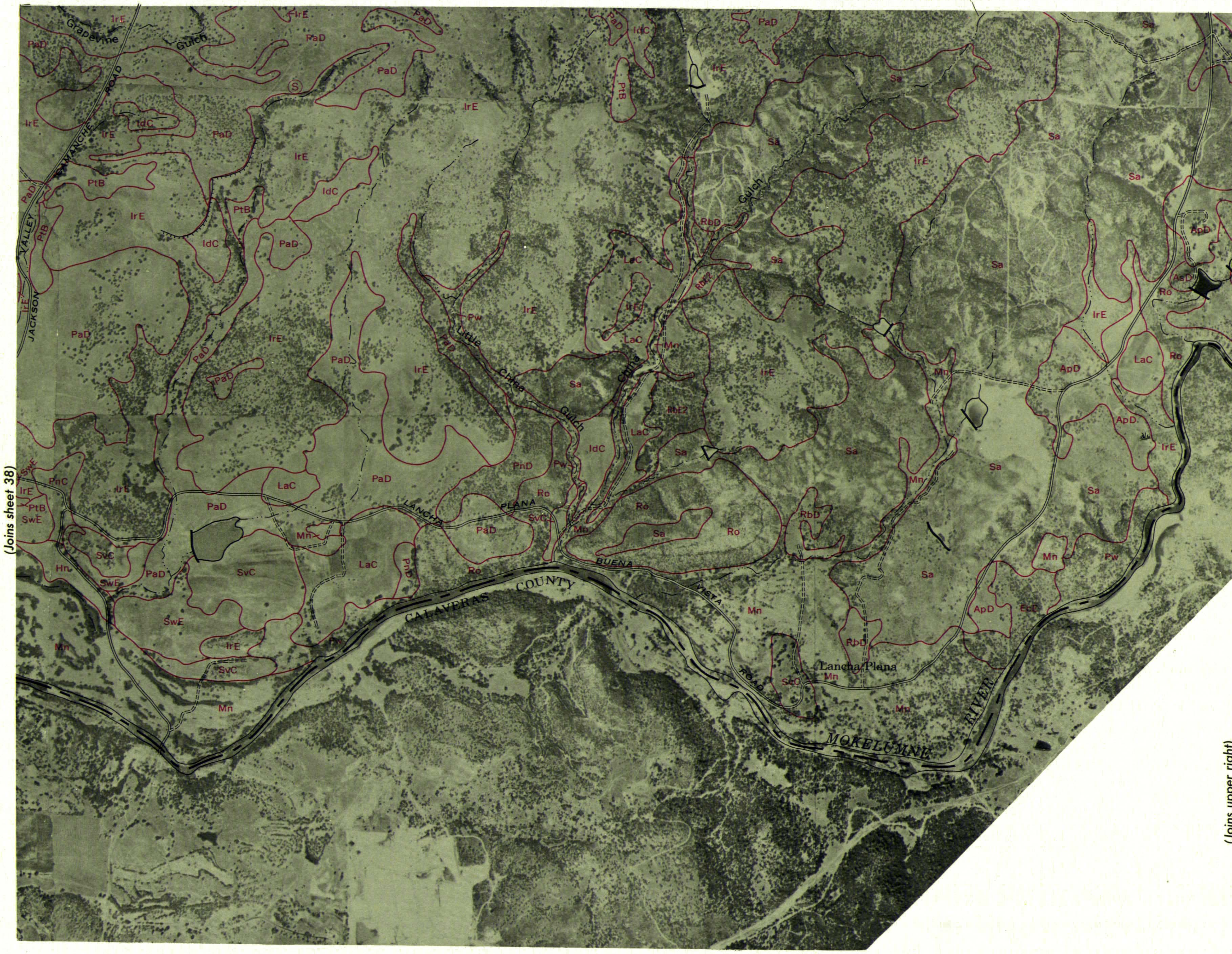
(Joins sheet 36)

39

(Joins inset, below)

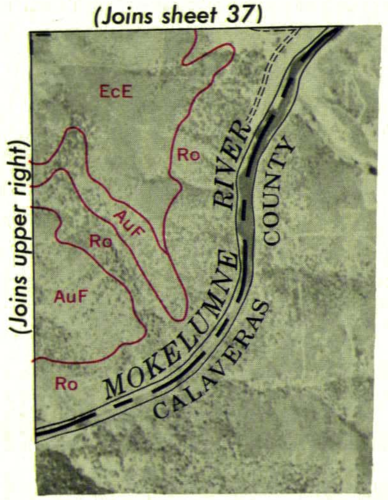
N

(Joins sheet 38)



(Joins sheet 37)

(Joins upper right)



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0 ½ 1 Mile Scale 1:20 000 0 5000 Feet

AMADOR AREA, CALIFORNIA

CONVENTIONAL SIGNS

WORKS AND STRUCTURES

Highways and roads

- Dual
- Good motor
- Poor motor
- Trail

Highway markers

- National Interstate
- U. S.
- State

Railroads

- Single track
- Multiple track
- Abandoned

Bridges and crossings

- Road
- Trail, foot
- Railroad
- Ferries
- Ford
- Grade
- R. R. over
- R. R. under
- Tunnel

- Buildings
- Station
- Mines and Quarries
- Mine dump
- Pits, gravel or other
- Power lines
- Pipe lines
- Cemeteries
- Dams
- Levees
- Tanks
- Oil wells
- Forest fire or lookout station

BOUNDARIES

- National or state
- County
- Reservation
- Land grant
- Project limit

DRAINAGE

Streams

- Perennial
- Intermittent, unclass.

- Canals and ditches — CANAL / DITCH

Lakes and ponds

- Perennial
- Intermittent

- Wells — flowing
- Springs
- Marsh
- Wet spot

RELIEF

Escarpments

- Bedrock
- Other

- Prominent peaks

Depressions

	Large	Small
Crossable with tillage implements		
Not crossable with tillage implements		
Contains water most of the time		

SOIL SURVEY DATA

- Soil boundary and symbol — Dx
- Gravel
- Stones
- Rock outcrops
- Chert fragments
- Clay spot
- Sand spot
- Gumbo or scabby spot
- Made land
- Severely eroded spot
- Blowout, wind erosion
- Gullies
- Soil sample site — S